Blumea 69, 2024: 36–48
www.ingentaconnect.com/content/nhn/blumea

RESEARCH ARTICLE

https://doi.org/10.3767/blumea.2024.69.01.05

Plant conservation in protected areas in Vietnam: an analysis from the Threatened Species Lists

Q.T. Do[1,2,*], F. Bravo[2], R. Sierra-de-Grado[2], V.S. Hoang[3,*]

Key words

IUCN classification system
limitation
management
monitoring
Vietnam Red Data Book

Abstract In order to guide national conservation policies, lists of nationally threatened plant species are a useful tool. To facilitate the national biodiversity commitments, Vietnam published a conservation management guide. We evaluated the application of these guidelines, focusing on the conservation programs within protected areas across the country. We sent a survey to management offices of 32 protected areas to assess the extent to which the threatened plant species lists have been used in official conservation efforts. We found that the IUCN Red List, the Vietnam Red Data Book and the national decrees are the principal guidelines for conservation prioritization. Besides describing characteristics of conservation programs for threatened plant species, we discovered that the species selected for the programs did not always adhere to the guidelines but showed more or less a rule of thumb in selecting species from lists. We highlight that this is not necessarily a bad implementation if taking into account the shortage of finance and maximizing the number of protected species. Thus, to enhance the utility of the lists for the conservation of threatened plant species, we advise users to recognize that the lists are not always updated, and to employ them as a reasonable reference rather than as the sole guideline.

Citation: Do QT, Bravo F, Sierra-de-Grado R, et al. 2024. Plant conservation in protexted areas in Vietnam: an analysis from the Threatened Species Lists. Blumea 69 (1): 36–48. https://doi.org/10.3767/blumea.2024.69.01.05.
Effectively published online: 10 May 2024.

INTRODUCTION

Native species are declining at an alarming rate and magnitude (IPBES 2019, WWF 2020), and global efforts are being made to reverse this trend (Dinerstein et al. 2020, Xu et al. 2021, GBS 2022). Among these efforts, having or creating protected areas are one of the most important elements (Secretariat of the Convention on Biological Diversity 2008, Secretariat of the Convention on Biological Diversity UNEP 2019, UNDP, SCBD, UNEP-WCMC 2021). Accordingly, countries agreed to expand the global terrestrial protected areas network to at least 17 % by 2020 (Aichi target 11, Secretariat of the Convention on Biological Diversity UNEP 2019) and 30 % by 2030 (Target 3, Kunming-Montreal Global Biodiversity Framework 2022). Consequently, global terrestrial and inland water protected areas and other effective area-based conservation measures (OECMs) reached 17.2 % (UNEP-WCMC 2023). To prevent further loss of known threatened species (Aichi target 12, Secretariat of the Convention on Biological Diversity UNEP 2019), the Global Strategy of Plant Conservation states that at least 60 % of threatened plant species should be within protected areas (Target 8).

Contributing to the global target, protected areas in Vietnam increased 93 % in area since 1985 and covered 7 % of the national terrestrial area in 2020 (Do et al. 2022). Protected areas serve dual goals of protecting biodiversity and securing ecosystem services. Conserving threatened plant species is one of the main objectives of the protected areas. To qualify as a protected area, threatened species have to be present, as stated in the Article 17 and Article 19 of the Law on Biodiversity (2008) and Article 6 of Decree 156/2018/ND-CP (2018) on detailing the Law on Forestry (2017).

The IUCN Red List of Threatened Species (http://www.redlist.org) is recognized as a useful global contribution for plant and animal conservation planning, management, monitoring and decision making (Rodrigues et al. 2006). In an attempt to apply the extinction risk criteria at sub-global levels, the IUCN Categories and Criteria published guidelines. As a result, the national threatened species lists have been expanded and widely used for conservation in Vietnam (Rodrigues et al. 2006, Miller et al. 2007, Mace et al. 2008). Vietnam developed authoritative sources of information regarding the conservation status of threatened plant species, namely the Vietnam Red Data Book, along with decrees for managing and preventing their illegal trade and for allocating conservation resources based on priority species. Nevertheless, there has been no formal review on how threatened plant species have been conserved within protected areas, particularly an analysis on how extensively the lists have been applied. Given that background, looking through the lens of the threatened plant species lists in Vietnam, our study was designed to:

1. explore the current use of threatened plant species lists;
2. investigate the current status and conservation programs of threatened plant species within protected areas; and
3. discuss ways to advance the lists application.

[1] Management Board for Forestry Projects, Ministry of Agriculture and Rural Development, Hanoi, Vietnam;
corresponding author e-mail: tung.kl@mard.gov.vn.
[2] Departamento de Producción Vegetal y Recursos Forestales, Instituto de Investigación en Gestión Forestal Sostenible (iuFOR), ETS de Ingenierías Agrarias, Universidad de Valladolid, Avda. de Madrid 44, 34004 Palencia, Spain.
[3] Vietnam National University of Forestry, Hanoi, Vietnam.
corresponding author e-mail: samhv@vnuf.edu.vn.

MATERIALS AND METHODS

Study sites

A total of 32 protected areas were selected that have the greatest relevance to Vietnam. National parks (NP) and nature reserves (NR) were included on the list, which are two of the most important types of protected areas (Do et al. 2022). The study sites covered a wide range of geographical areas and were spread throughout the country (Fig. 1). The selected protected areas vary in size and governance. The smallest protected area covers 538 hectares (Hung Kings NP), while the largest one is 115 545 hectares (Yok Don NP). Protected areas that cover more than one province are managed at the national level (VNFOREST), areas within provinces are managed at the provincial (PCC) level, or at the sector level (DARD). To be established, national parks must meet higher criteria than nature reserves. A national park must have at least 7 000 hectares, often has significant biodiversity values, and is approved by the central government. While a nature reserve must have at least 5 000 hectares, often has less biodiversity values, and is approved by provincial governments (Article 6, Decree 156/2018/ND-CP 2018). For instance, during this study time, Xuan Lien nature reserve was preparing to be approved as a national park.

Data collection

Primary data collection — In August 2022, we conducted a survey via emails to key informants of the 32 protected areas, of which five protected areas were combined with field visits: Ba Vi, Ben En, Bu Gia Map, Dong Nai, and Yok Don. Our aim was to understand how they actually manage threatened plants. The key informants were employees, who were assigned for biodiversity conservation activities. They were often heads of scientific departments or research offices of the selected protected areas. There were ten questions with two components: 1) acquiring general information about the protected area; and 2) an in-depth questionnaire about the conservation programs focused on threatened plant species (see Appendix for questions and answers). Following the survey and field visits, we received responses from all 32 protected areas. If necessary, we contacted the protected areas again by telephone to obtain additional information. In the Appendix, we summarized all the collected data, however in some protected areas, questions that were not answered due to uncertainties with the respondents.

Secondary data collection — As part of our analysis of how by legal right threatened plants are conserved in protected areas, we processed relevant national legal regulations that are the most important for their conservation. We examined the

Fig. 1 Distribution of the 32 protected areas.

Table 1 Secondary data sources collection.

No.	Name of secondary data sources	Examined contents	Address of the contents
1	Law on Biodiversity 2008	Definitions of *in situ*, *ex situ* conservation; endangered precious and rare species prioritized for protection	Heading 2, 3 and 20, Article 3
		Conservation areas and classification of conservation areas; major criteria of national parks, nature reserves	Article 16, 17, 18
		Contents of a conservation area establishment project	Article 21
		Reporting on the current status of conservation areas' biodiversity	Article 33
2	Law on Forestry 2017	National parks, natural reserves classification	Heading 2, article 5
		National parks, natural reserves development	Heading 1, article 46
		Use of forest products in National parks, natural reserves	Heading 1, article 52
3	Decree 160/2013/ND-CP and Decree 64/2019/ND-CP a system of criteria for evaluating and identifying wildlife species listed in the list of endangered precious and rare species prioritized for protection	Criteria to determine species prioritized protection	Article 4
		Lists of endangered, precious, and rare plant species prioritized in protection	Heading 1, ANNEX I
4	Decree 156/2018/ND-CP on enforcement of a number of articles of the law on forestry	Criteria applied for National parks, natural reserves	Heading 1, 2 article 6
		Protection, monitoring, surveillance, rescue and nurture of endangered and rare forest plants	Heading 2, article 87
5	Decree 06/2019/ND-CP and Decree 84/2021/ND-CP on the management of endangered, precious and rare forest plants and animals and implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	List of the endangered, precious and rare forest plants	Group IA and IIA, Appendix I

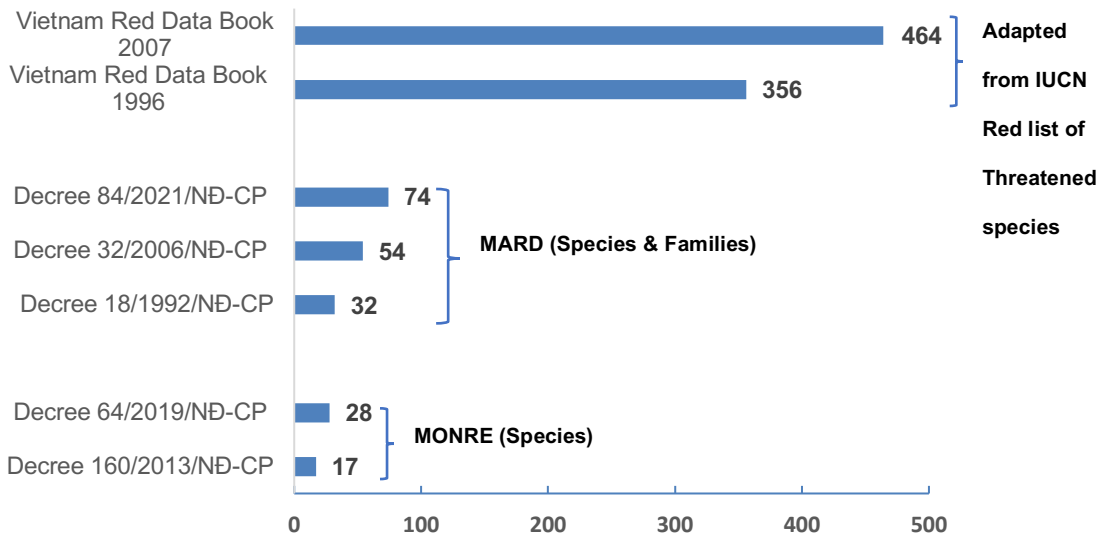
contents of the principles, articles, and rules that were relevant to the classification of threatened plant species, monitoring requests, conservation methods, and conservation priority criteria. Our main references are listed in Table 1.

RESULTS

Lists of threatened plant species in Vietnam

Three principal lists of threatened plant species have been simultaneously used in Vietnam. The Vietnam Red Data Books were published by the Science and Technology Publishing House (1996) and Vietnam Academy of Science and Technology Publishing House (2007). The two decrees were issued by the Ministry of Agriculture and Rural Development (MARD) and by the Ministry of Natural Resources and Environment (MONRE) (Fig. 2). The MARD and the MONRE together assigned the highest priority to protect threatened plant species.

First, under IUCNs attempt to establish a threatened species list at the national level, the Vietnam Red Data Books was established. Two editions were published, the first in 1996 (Nguyen et al. 1996) and the second in 2007 (Tran et al. 2007). The first edition was based on the five categories of IUCN (Mace et al. 1992). After 15 years, the second edition was updated to the new eight categories of IUCN Species Survival Commission (1994). Accordingly, species are divided into: Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Extinct in the Wild (EW), and Extinct (EX). There are a total of 448 species of threatened vascular plants present in Vietnam listed in the



* MARD: Ministry of Agriculture and Rural Development; MONRE: Ministry of Natural Resources and Environment.

Fig. 2 Database of threatened species for conserving and managing threatened plant species as issued by different sources.

Table 2 Description of the primary purpose and actual use of the threatened species lists (adapted from Possingham et al. (2002)).

Threatened species classification systems	Use*				Primary purpose of the list	Refs
	U1	U2	U3	U4		
IUCN	X	X	X	X	Assess risk	IUCN (1994) IUCN Red List Categories, IUCN Species Survival Commission, The World Conservation Union
Vietnam Red Data Book 2007	X	X	X	X	Assess risk	
Decree 84/2021/ND-CP (2021)	X	X	X	X	Manage risk and support CITES implementation, Constrain trade, Check list for illegal activities against the species protection	Decree 84 (by MARD)
Decree 64/2019/ND-CP (2019)	X	X			Set conservation priorities	Decree 64 (by MONRE)

* U1: Recovery resource allocation; U2: reserve system design; U3: constrain development; U4: National reporting of environment conditions. The presence of an X indicates how a list has been used.

second edition, of which 4 (NT), 209 (VU), 189 (EN), 45 (CR), and 1 (EW). The numbers indicate a remarkable increase in the number of threatened plants, which was only 356 in the book's first version in 1996.

Second, to better manage endangered, precious and rare forest fauna and flora, and implement CITES (convention on International Trade of Endangered Species of Wild Fauna and Flora), MARD issued several decrees. The latest one is Decree 84/2021 (2021), which lists two groups of species, IA and IIA, which are plants native to Vietnam and restricted from exploitation and commercial use. IA refers to forest plant species that are threatened with extinction and listed in CITES Appendix I. IIA refers to species of forest plant species that are not yet threatened with extinction but are in danger of being threatened if they are not strictly managed, and these are listed in CITES Appendix II. These groups, including but not limited to, are used as reference check for illegal activities, e.g., national and oversea trade. Compared to the Red Data Book, the decree simplified the threatened plant taxonomy into just the two categories: IA and IIA.

Third, the Decree 64/2019 (2019), issued by the MONRE, lists 28 endangered, precious and rare species, which are prioritized for allocating conservation funds. To receive grants for conservation activities, particularly from financial sources of MONRE, the species should be in this list. However, it is not restricted to only this application (see more in Table 2).

The three lists all show an upward trend in the number of plants species under threat. Since the amended decrees issued longer lists than the earlier decrees, one can argue that either more species are currently protected or that more species have become endangered.

The actual and by law use of the three lists

The three lists share a similar general objective of protecting threatened plant species, but their applications differ. Compared to their *by law* formulation, their *actual* use is substantially more diverse (Table 2). Species ranked at high extinction risk receive attention from conservation measures and are therefore given priority in the allocation of resources for their recovery (U1). The present of these species is also used as one of mandatory criteria to establish protected areas (U2). Furthermore, the threatened species lists may be used as a tool in environment impact assessment of social-economic development activities. When these activities pose a risk to threatened species, they might be modified or postponed (U3). Lastly, the threatened species lists may be used in national reports on biodiversity to provide information to the public, for example, changes in the total number of threatened species (U4).

Status of threatened plant species at the studied protected areas

The number of threatened species, including the updated lists, varied among the protected areas (Table 3). Most of the data were updated in 2014, when the government took nationwide measures under the project 'Investigation, Research, and Amendment of Vietnam Red Data Book'. Since then, or in some cases since the protected areas were established, the threatened species data had either not been updated or, if it had, was limited in scale, i.e., single species level. *By law*, however, requires that this measure should be conducted every three years or upon request (Article 40, Law on Biodiversity 2008). Hence, most protected areas are far behind in implementing what the law requires. In other words, the focus is more on guidelines and desires than on the actual capacity of the protected area management. During the survey, many informants reported that they did not have periodic monitoring, because their activities greatly relied on financial availabilities. They also mentioned that some individual projects exist via which they obtained more updated information on threatened plant species. However, this information was often limited in scale, such as concentrated on single species or inventorying small sites.

CONSERVATION PROGRAMS OF THREATENED PLANT SPECIES

Quantity and methods of conservation programs

Among the many recognized threatened species, only a small number of species had an actual conservation program. Rarely did the interviewees mention more than 7 species with active management; nevertheless, Cuc Phuong NP reported 88 conserved species. With 65 %, the *in situ* conservation management was the most popular approach. These programs were often conducted at five subsequent levels, looking at factors related to species distributions, such as age structure, ecological traits, regrowth potential and environmental and human influence factors. The sophistication of these projects mainly depended on funds allocated.

Most of the protected areas have botanical gardens or genetic garden collections. Threatened species can be collected from outside and inside the protected areas to plant in these gardens. This study indicated that 66 % of protected areas only practice *in situ* conservation, 34 % practice *in situ* and *ex situ* conservation.

National parks like Ba Vi, Cuc Phuong, and Phong Nha Ke Bang are successful examples of *in situ* and *ex situ* conservation. Their gardens planted threatened species not only found within their protected areas but also collected from other geographical sites.

Table 3 Characteristics of the studied protected areas based on data collected by the first author.

No.	Name of Protected Area	Date of establish-ment	Governance	Total area (Ha)	Total identified plant species	Recorded threatened plant species		
						IUCN Red List	Vietnam's Red Data Book 2007	Decree 84/2021
1	Ba Vi NP	1991	VNFOREST	9702	2181	46	64	27
2	Bach Ma NP	1987	VNFOREST	37423	1728	52	70	20
3	Ben En NP	1996	PPC	14305	1417	58	47	17
4	Bidoup – Nui Ba NP	2004	PCC	69663	2089	35	74	18
5	Binh Chau – Phuoc Buu NR	1987	PCC	10284	795	20	18	12
6	Bu Gia Map NP	2002	PCC	25651	1117	22	20	17
7	Cat Tien NP	1992	VNFOREST	71188	1655	45	39	12
8	Chu Mom Ray NP	2002	PCC	56257	1895	20	48	26
9	Chu Yang Sin NP	2002	PCC	59478	951	26	51	22
10	Cuc Phuong NP	1962	VNFOREST	22409	2234	89	77	36
11	Dong Chau – Khe Nuoc Trong NR	2020	PCC	22133	1030	22	26	15
12	Dong Nai NR	2003	PCC	100572	1552	40	44	24
13	Dong Son – Ky Thuong NR	2003	DARD	15594	546	31	43	16
14	Hoang Lien NP	2002	PCC	28498	2847	66	96	35
15	Hung Kings NP	1976	PCC	538	636	17	15	4
16	Kim Hy NR	2003	DARD	15715	1072	12	57	20
17	Muong Nhe NR	1976	DARD	46731	742	11	23	3
18	Ngoc Son NR	2004	DARD	15105	667	29	28	7
19	Phu Canh NR	2001	DARD	5092	756	29	44	8
20	Pu Hoat NR	2013	DARD	34590	2425	75	62	25
21	Pu Hu NR	1999	DARD	24201	1725	96	52	16
22	Pu Luong NR	1999	DARD	16986	1579	106	58	23
23	Pu Mat NP	2001	PCC	94715	2691	67	75	19
24	Ta Dung NR	2018	DARD	20974	1406	27	69	14
25	Than Sa – Phuong Hoang NR	1999	DARD	19914	1239	45	57	22
26	Thuong Tien NR	2000	DARD	6314	648	32	39	12
27	U Minh Thuong NP	2002	DARD	8038	258	2	3	1
28	Vu Quang NP	2002	PCC	52741	1828	74	51	74
29	Xuan Lien NR	1999	DARD	23816	1228	61	59	22
30	Xuan Nha NP	2002	DARD	18173	1131	26	21	18
31	Xuan Son NP	2002	DARD	15048	1259	47	46	15
32	Yok Don NP	1992	VNFOREST	115545	1006	65	85	22

* DARD: Department of Agriculture and Rural Development; NP: National Park; NR: Nature Reserve; PCC: Provincial People's Committee; VNFOREST: Vietnam Administration of Forestry, Ministry of Agriculture and Rural Development.

Funding sources of conservation programs

The conservation programs were financed by four different types of funding: 1) central government; 2) provincial government; 3) international organizations; and 4) domestic sources (Fig. 3). The programs funded exclusively by provincial budgets accounted for nearly 38 % of the funded species conservation projects, followed by the central budget, while the remainder received a mixture of funding from more than two sources. The governance category will also define the funding source for conservation, i.e., protected areas under central government management often have more funding possibilities than non-central government managed protected areas. This could lead to inefficient funding assignment in terms of conservation priorities. For example, Pu Hoat, Pu Hu, or Thuong Tien protected areas have an extremely rich biodiversity but very limited funds available, because funding in these provinces for conservation is low.

Conservation has a consistent budget, primarily for salaries rather than for programs for protecting threatened species. Instead, these protecting programs heavily rely on ad hoc funding by the provinces, which tend to be unpredictable and on a short term. Funding also depends on the effectiveness of the management of the protected areas, i.e., how capable or proactive they are in seeking funds. Vietnam has received substantial grants from international organisations to support conservation efforts; yet, it appears that officers in protected areas are facing challenges to acquire this funding as it often requires writing a grant proposal in English.

Selection of threatened plant species in conservation programs

The selection of threatened species as listed in IUCN (2022), the Vietnamese Red Book (Tran et al. 2007), and the current management decrees, was not always followed by the protected areas surveyed (Fig. 4), with some areas protecting more species then required, while others protected less.

There was quite some overlap between species in the funded programs and those suggested for conservation in the future. For instance, *Cinnamomum parthenoxylon* (Jack) Meisn. (*Lauraceae*) was mentioned by Ben En, Bach Ma, Chu Mom Ray,

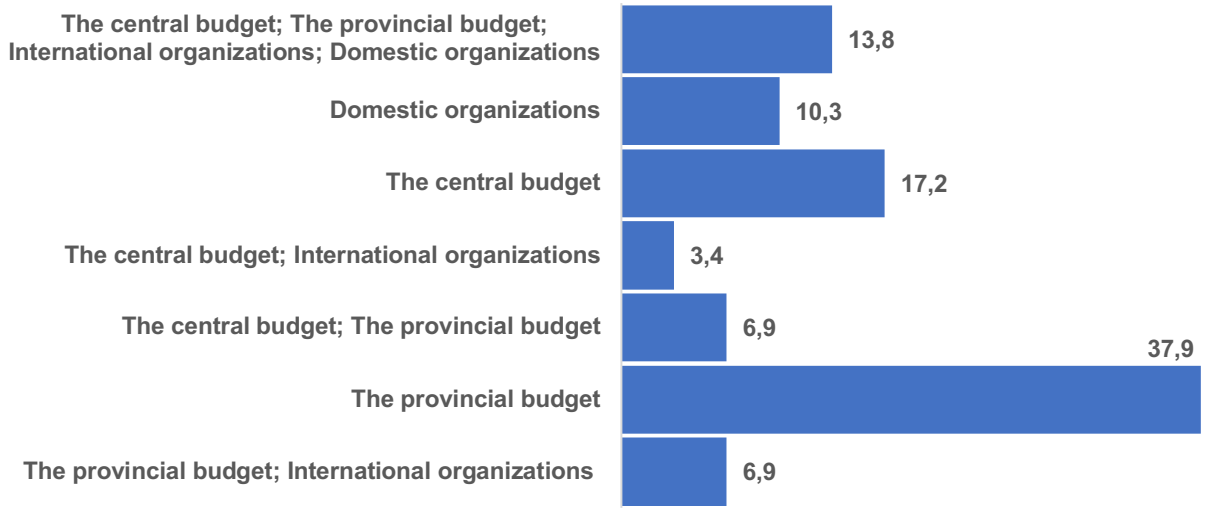
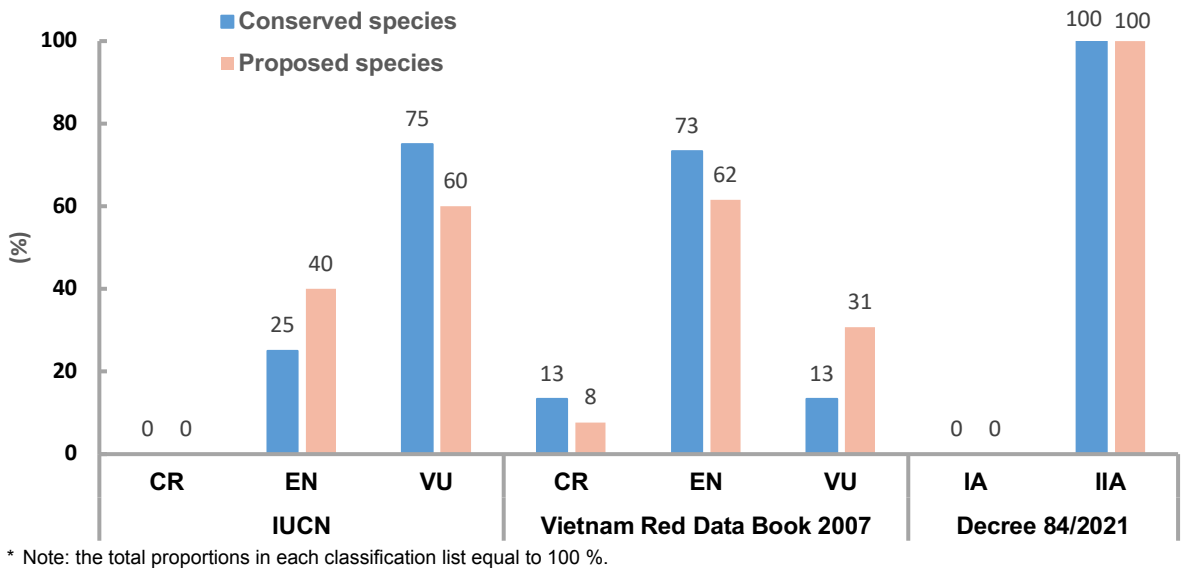


Fig. 3 Funding sources of threatened plant species conservation programs.



* Note: the total proportions in each classification list equal to 100 %.

Fig. 4 The proportions of actually conserved and proposed threatened plant species for conserving according to the three classification lists, based on the survey of 32 protected areas (CR, EN, VU, and IA and IIA are explained above).

Cuc Phuong, Hung Temper, Pu Hu, Pu Luong, Thuong Tien, Xuan Lien protected areas (Appendix). If this was the case, either the managers did not update previous relevant programs from other protected areas, or this species is still considered endangered in their ecogeographical protected areas.

All species mentioned by interviewees fall in at least one of the three lists, implying that the classifications are well acknowledged by managers, but that they may be confused about which list to use.

Facing challenges

To conserve threatened plant species, the national parks face several management challenges (Fig. 5). Financial and human resource shortages are the most cited challenges, followed by exploitation pressures due to the high proportion of people relying on forest resources. It is also difficult for managers to identify rare and endangered plant species due to their limited knowledge of these species. Further, the demand for rare and endangered species is high, particularly for medicinal plants.

The interviewees also stated that, compared to threatened fauna, threatened flora receives less attention in the media. Since land use change directly affects animal habitat, fauna protection requires more resources, reducing funding available for protecting plants.

DISCUSSION

Vietnam faces serious challenges in the protection of its rich biodiversity, including, e.g., finance shortage, limited human resources, high numbers of people depending on forests for income and food. Here we focus on a selection of the most pressing problems.

The threatened plant species lists: A need to avoid contradiction and more updating.

The Ministry of Agriculture and Rural Development (MARD) and the Ministry of Natural Resources and Environment (MONRE) are in principle responsible for the management and conservation of rare and endangered plant species. The governance ranges from what (e.g., the definitions), where (e.g., *in situ* conservation at national parks, nature reserves), to how (e.g., controlling the illegal gathering, storing, transferring, and selling). However, there are overlaps and even contradictions between

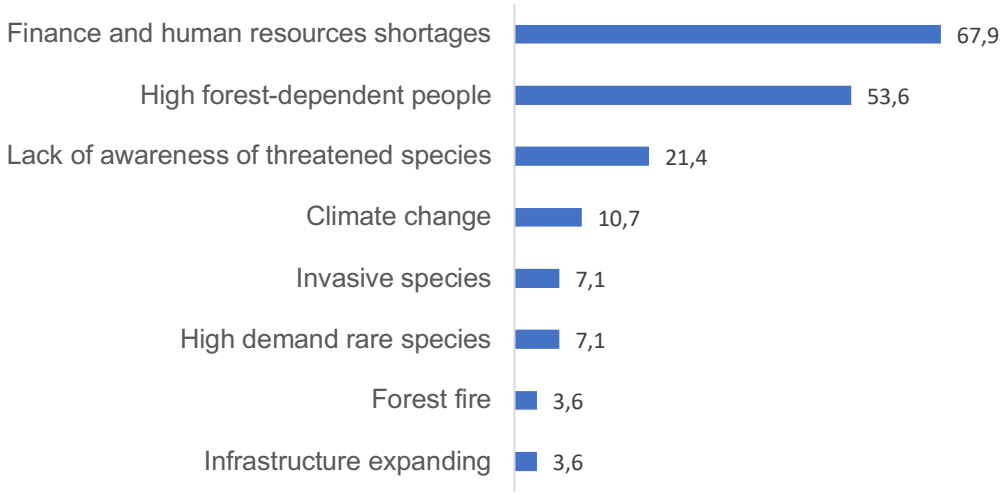


Fig. 5 Challenges faced by protected area management offices.

these two authorities. For instance, MONRE issued a priority list of protecting endangered, precious and rare species (Decree 64/2019/ND-CP 2019), which is entirely overlaping with the list mentioned in IA of MARD (Decree 84/2021/ND-CP 2021). Furthermore, contradictions between the law on biodiversity and the law on forestry exist about the number of threatened species needed to declare an area to be protected. Article 17, of the law on biodiversity requires at least one threatened species, while Article 6, Decree 156 (2018) of the forestry law requires at least 5 threatened species.

The Vietnam Red Data Book (Tran et al. 2007) was last updated 16 years ago. Although, it has been widely used as a reference by conservation managers, natural conservationists and botanists to determine the threat level of areas and to prioritize finance allocation, it hardly serves as an up-to-date source. For instance, *Aquilaria crassna* Pierre ex Lecomte (*Thymelaeaceae*) is classified as 'critically endangered', *Erythrophleum fordii* Oliv. (*Fabaceae*) and *Parashorea chinensis* Wang Hsie (*Dipterocarpaceae*, presently a synonym of *Shorea wangtianshuea* Y.K.Yang & J.K.Wu) as 'endangered', and *Dalbergia tonkinensis* Prain (*Fabaceae*) as 'vulnerable', even though they may be abundant outside protected areas, e.g., home gardens of local people (Mulia et al. 2018). These species were often protected and planted by local people on their own initiative, because they have a high economic value. Meanwhile, the threat status of many other species has not yet been assessed or updated to determine if they should be listed or if their threat status should be reduced or increased. Consequently, many endangered species may not qualify for funding since the Red Book does not include them.

The threatened plant species lists in the decission making process: mind the limitations in use

Our study revealed that the three available threatened species lists were not always used to prioritize species with higher threat levels (Fig. 4). Although there is no doubt that the lists of threatened plant species have served as a reliable reference for conservation programs, and the wish that funding should be prioritized for more threatened species within a taxonomic group, investing most of the available funding in the most threatened species is not always the most effective strategy. The most threatened species could require a large budget, because they may be more difficult to conserve than less endangered species (Possingham et al. 2002), as the most threatened plant species are often found in difficult terrain or less accessible areas Pham et al. (2020). Thus, it is not too surprising that conservation programs do not always select species in the highest threat categories within a taxonomy group.

Relying on threatened species alone as a conservation system can be problematic. In Vietnam, the presence of threatened plant species within the classification lists have been used as one of foremost criteria for establishing protected areas. Concerns can be raised on the use of only threatened species as a biological justification for establishing protected areas as it ignores the complex interplay between species communities and the environment. Also, most non-vascular plants are not included in any of the threatened species lists (Possingham et al. 2002) Many threatened species are found outside protected areas (Venter et al. 2014, Tyrrell et al. 2020, Kearney et al. 2022). Thus, when adhereing to the threatened species criteria alone, these species will be precluded from any protection. In addition, the threatened species lists used often lag behind the *de facto* status of threatened species. The Vietnamese Red Data Book (Tran et al. 2007) has acknowledged the scientific weaknesses due to limited availability of updated data on rare and threatened species and unknown factors influencing them (Do et al. 2018). Altogether, it is important to emphasise that presence of threatened plant species should not be used as the only criterion to establish ecological reserves.

CONCLUSION

We have provided a picture of *in situ* conservation based on threatened plant species lists. Our case study focused on the application of lists in protected areas. In response to IUCNs guidelines (Mace et al. 1992, IUCN Species Survival Commission 1994) for applying the threatened species classification system to national levels, Vietnam published the Vietnamese Red Data Books version (Nguyen et al. 1996, Tran et al. 2007) and issued relevant decrees to protect these species. Since the lists were published, they have been used as a key tool in conservation. We have discussed their limitations and use in conservation decision-making processes. Updates that are late and overemphasising the presence of these species are the remaining issues that we need to be aware of to maximise the effectiveness of conservation programs. Despite this, the lists remain valuable in providing comprehensive and scientifically sound information about the conservation status of threatened plant species. Therefore, improving the quality of the lists and keeping them up to date should be a priority goal, as well as trying to get a threat listing for all plant species in Vietnam, also the ones outside protected areas.

Acknowledgements We very much appreciate the dedicated key informants from the 32 protected areas, who replied to our survey. We also would like to thank two anonymous reviewers and the editor for their valuable comments, which helped improve our manuscript significantly. All of the data sets, including the decrees (in Vietnamese) can be obtained from the first author in electronic format.

REFERENCES

Decree 06/2019/ND-CP. 2019. On the management of endangered, precious and rare forest plants and animals and implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Hanoi. https://vanban.chinhphu.vn/default.aspx?pageid=27160&docid=196022.

Decree 64/2019/ND-CP. 2019. A system of criteria for evaluating and identifying wildlife species listed in the list of endangered precious and rare species prioritized for protection. Hanoi. https://datafiles.chinhphu.vn/cpp/files/vbpq/2019/07/64.signed.pdf.

Decree 84/2021/ND-CP. 2021. On management of endangered, precious and rare forest plants and animals and implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Hanoi. https://vanban.chinhphu.vn/default.aspx?pageid=27160&docid=204157.

Decree 156/2018/ND-CP. 2018. On enforcement of a number of articles of the law on forestry. Hanoi. https://vanban.chinhphu.vn/?pageid= 27160&docid=195435.

Decree 160/2013/ND-CP. 2013. On criteria to determine species and the regime of managing species under lists of endangered, precious and rare species prioritized protection. https://chinhphu.vn/default.aspx?pageid=27160&docid=170893.

Dinerstein E, Joshi AR, Vynne C, et al. 2020. A "Global Safety Net" to reverse biodiversity loss and stabilize Earth's climate. Science Advances 6 (36):eabb2824. https://doi.org/10.1126/sciadv.abb2824.

Do Q, Bravo F, Sierra-de-Grado R, et al. 2022. Global biodiversity-related conventions on facilitating biodiversity conservation in Vietnam. Forest and Society 6 (2): 489–502. https://doi.org/10.24259/fs.v6i2.14473.

Do TH, Krott M, Juerges N, et al. 2018. Red lists in conservation science-policy interfaces: A case study from Vietnam. Biological Conservation 226: 101–110. https://doi.org/10.1016/j.biocon.2018.07.016.

GBS - The Global Biodiversity Standard. 2022. https://www.biodiversitystandard.org/what-is-the-global-biodiversity-standard/ [accessed Dec. 2023].

IPBES. 2019. Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

IUCN. 2022. The IUCN Red List of Threatened Species. https://www.iucnredlist.org [accessed May 2022].

IUCN Species Survival Commission. 1994. IUCN Red List Categories. In: As approved by the 40th Meeting of the IUCN Council Gland, Switzerland, 1994. World Conservation Union, Gland, Switzerland,

Kearney SG, Carwardine J, Reside AE, et al. 2022. Saving species beyond the protected area fence: Threats must be managed across multiple land tenure types to secure Australia's endangered species. Conservation Science and Practice 4 (3): e617-e617. https://doi.org/10.1111/csp2.617.

Kunming-Montreal Global Biodiversity Framework. 2022. Decision adopted by the conference of the parties to the convention on biological diversity. Montreal. https://www.cbd.int/doc/c/e6d3/cd1d/daf663719a03902a9b116c34/cop-15-l-25-en.pdf.

Law on Biodiversity. 2008. The National Assembly of Vietnam. Hanoi. https://vanban.chinhphu.vn/default.aspx?pageid=27160&docid=81137.

Law on Forestry. 2017. The National Assembly of Vietnam. Hanoi. https://vanban.chinhphu.vn/?pageid=27160&docid=192329.

Mace GM, Collar NJ, Gaston KJ, et al. 2008. Quantification of extinction risk: IUCN's System for Classifying Threatened Species. Conservation Biology 22 (6): 1424–1442.

Mace GM, Nj C, Cooke J, et al. 1992. The development of new criteria for listing species on the IUCN Red List. Species 19: 16–22.

Miller RM, Rodríguez JP, Aniskowicz-Fowler T, et al. 2007. National Threatened Species Listing based on IUCN Criteria and Regional Guidelines: Current status and future perspectives. Conservation Biology 21 (3): 684–696. https://doi.org/10.1111/j.1523-1739.2007.00656.x.

Mulia R, Simelton E, Le TT, et al. 2018. Native and endangered timber tree species in home gardens of North East and North Central Vietnam. Biodiversity International Journal 2 (1): 40–43. https://doi.org/10.15406/bij.2018.02.00041.

Nguyen T, Tran D, Nguyen K. 1996. Vietnam Red Data Book: Volume 2. Plants. Vietnam Red Data Book. Science and Technology Publishing House, Hanoi

Pham VV, Ammer C, Annighöfer P. 2020. The presence of IUCN Red List Tree species in dependence of site characteristics in the Vietnamese Cat Ba National Park. Diversity 12 (3), 104. https://doi.org/10.3390/d12030104.

Possingham H, Andelman S, Burgman MA, et al. 2002. Limits to the use of threatened species lists. Trends in Ecology & Evolution 17 (11): 503–507. https://doi.org/10.1016/S0169-5347(02)02614-9.

Rodrigues A, Pilgrim J, Lamoreux J, et al. 2006. The value of the IUCN Red List for conservation. Trends in Ecology & Evolution 21 (2): 71–76. https://doi.org/10.1016/j.tree.2005.10.010.

Secretariat of the Convention on Biological Diversity. 2008. Protected areas in today's world: their values and benefits for the welfare of the planet. Montreal. https://www.cbd.int/doc/publications/cbd-ts-36-en.pdf.

Secretariat of the Convention on Biological Diversity UNEP. 2019. Strategic plan for biodiversity 2011–2020 and the Aichi targets: living in harmony with nature. https://wedocs.unep.org/20.500.11822/27533.

Tran P, Tran T, Le D, et al. 2007. Vietnam Red Data Book - Part II. Plants. Vietnam Red Data Book. Vietnam Academy of Science and Technology Publishing House, Hanoi.

Tyrrell P, Du Toit JT, Macdonald DW. 2020. Conservation beyond protected areas: Using vertebrate species ranges and biodiversity importance scores to inform policy for an east African country in transition. Conservation Science and Practice 2 (1): e.136. https://doi.org/10.1111/csp2.136.

UNDP, SCBD, UNEP-WCMC. 2021. Creating a nature-positive future: The contribution of protected areas and other effective area-based conservation measures. UNDP. New York, NY. https://www.undp.org/sites/g/files/zskgke326/files/2021-11/UNDP-UNEP-Creating-a-Nature-Positive-Future-EN.pdf.

UNEP-WCMC. 2023. Protected Planet Live Report 2023. www.protectedplanet.net [accessed Sept. 2023].

Venter O, Fuller RA, Segan DB, et al. 2014. Targeting global protected area expansion for imperiled biodiversity. PLoS Biology 12 (6): e1001891. https://doi.org/10.1371/journal.pbio.1001891.

WWF. 2020. Living Planet Report 2020 – Bending the curve of biodiversity loss. WWF. Gland, Switzerland.

Xu H, Cao Y, Yu D, et al. 2021. Ensuring effective implementation of the post-2020 global biodiversity targets. Nature Ecology & Evolution 5 (4): 411–418. https://doi.org/10.1038/s41559-020-01375-y.

Appendix Question 1–6 part 1.

No	Question 1: Could you please provide some general information about name, the area, the date of establishment, and the governance.	Question 2: How many threatened plant species have been identified within your protected area? (IUCN, Vietnam's Red Data Book, Decree 84/2021)?			Question 3: Does your protected area have any conserved programs	Question 4: What are the conserved methods for threatened plant species? If yes, how many and what are they? Which species?	Question 5: What are the sources of funding for these conserved (*in situ*; *ex situ* or both)?	Question 6: In your opinion, the number of threatened species programs? Increased or decreased over time?
	Name of protected areas	Threatened plant species			Some conserved species (*)	Conservation methods	Financial sources	Quantity of threatened plant species
		IUCN Red List	Vietnam's Red Data Book 2007	Decree 84/2021				
1	Ba Vi	46	64	27	*Asarum glabrum*; *Disporopsis longifolia*; *Stephania dielsiana*; *Cinnamomum balansae*; *Calocedrus macrolepis*; *Amentotaxus oliver*; *Cephalotaxus mannii*; *Podocarpus neriifolius*; *Madhuca pasquieri*; *Quercus platycalyx*; *Quercus macrocalyx*; *Cinnamomum paniculata*; *Tacca chantrieri*; *Podophyllum tonkinense*; *Anoectochilus* sp.; *Ardisia gigantifolia*; *Carex bavicola*	*in situ* & *ex situ*	The central budget; the provincial budget; international organization support; domestic organization support	No change
2	Bach Ma	52	70	20	*Hopea siamensis*; *Cinnamomum parthenoxylon*; *Sindora tonkinensis*	*in situ* & *ex situ*	The central budget	No change
3	Ben En	58	47	17	*Dysoxylum cauliflorum*; *Parashorea chinensis*; *Erythrophloeum fordii*; *Hopea hananensis*; *Cinnamomum parthenoxylon*; *Annamocarya sinensis*	*in situ*	The provincial budget; international organization support	No change
4	Bidoup - Nui Ba	35	74	18	*Pinus krempfii*; *Pinus dalatensis*; some *Camellia*	*in situ* & *ex situ*	The provincial budget; international organizations	No change
5	Binh Chau - Phuong Buu	20	18	12	On the way to apply	*in situ*	The provincial budget	Increase
6	Bu Gia Map	22	20	17	*Dalbergia oliveri*; *Afzelia xylocarpa*; *Anisoptera costata*; *Dendrobium chrysotoxum*; *Dendrobium amabile*; *Pterocarpus macrocarpus*	*in situ*	The provincial budget	No change
7	Cat Tien	45	39	12	*Camellia* sp.; *Afzelia xylocarpa*; *Dalbergia oliveri*	*in situ*	The central budget; the provincial budget; international organization support; domestic organization support	Increase
8	Chu Mom Ray	20	48	26	*Cinnamomum parthenoxylon*; *Dalbergia oliveri*; *Dalbergia cochinchinensis*	*in situ* & *ex situ*	The provincial budget	Increase
9	Chu Yang Sin	26	51	22	None	*in situ*	The provincial budget	No change
10	Cuc Phuong	89	77	36	Many (*Dalbergia tonkinensis*; *Dysoxylum cauliflorum*; *Podocarpus neriifolius*; *Nageia fleuryi*; *Cinnamomum parthenoxylon*; *Garcinia fagraeoides A.*; *Camellia* sp. etc.,)	*in situ* & *ex situ*	The central budget; the provincial budget; international organization support; domestic organization support	Decrease
11	Dong Chau - Khe Nuoc Trong	22	26	15	None	*in situ*	The central budget; the provincial budget; international organization support; domestic organization support	No change
12	Dong Nai	40	44	24	*Afzelia xylocarpa*; *Sindora siamensis*; *Dalbergia mammosa*; *Pterocarpus macrocarpus*; *Anisoptera costata*	*in situ* & *ex situ*	The central budget	Increase
13	Dong Son - Ky Thuong	31	43	16	*Amentotaxus argotaenia*; *Podocarpus fleuryi*	*in situ*	The provincial budget	Increase
14	Hoang Lien	66	96	35	*Fokienia hodginsii*; *Abies delavayi* subsp. *fansipanensis*; *Amentotaxus argotaenia*	*in situ* & *ex situ*	The central budget; the provincial budget; international organization support; domestic organization support	Increase
15	Hung King national forest	17	15	4	None	*in situ*	domestic organization support	Increase

Appendix Question 1–6 part 2.

No	Question 1: Could you please provide some general information about name, the area, the date of establishment, and the governance.	Question 2: How many threatened plant species have been identified within your protected area? (IUCN, Vietnam's Red Data Book, Decree 84/2021)?			Question 3: Does your protected area have any conserved programs	Question 4: What are the conserved methods for threatened plant species? If yes, how many and what are they? Which species?	Question 5: What are the sources of funding for these conserved (*in situ*; *ex situ* or both)?	Question 6: In your opinion, the number of threatened species programs? Increased or decreased over time?
	Name of protected areas	Threatened plant species			Some conserved species (*)	Conservation methods	Financial sources	Quantity of threatened plant species
		IUCN Red List	Vietnam's Red Data Book 2007	Decree 84/2021				
16	Kim Hy	12	57	20	*Keteleeria davidiana*; *Pseudotsuga brevifolia*	*in situ*	The central budget	Decrease
17	Muong Nhe	11	23	3	None	*in situ*	The provincial budget, domestic organization support	No change
18	Ngoc Son	29	28	7	None	*in situ*	The provincial budget	No change
19	Phu Canh	29	44	8	None	*in situ*	Domestic organization support	No change
20	Pu Hoat	75	62	25	*Cunninghamia konishii*	*in situ*	The central budget	Increase
21	Pu Hu	96	52	16	*Podocarpus neriifolius*; *Anoectochilus calcareus*; *Madhuca pasquieri*	*In situ*	The provincial budget	No change
22	Pu Luong	106	58	23	*Taxus chinensis*; *Pinus kwangtungenssis*	*in situ* & *ex situ*	The provincial budget	No change
23	Pu Mat	67	75	19	*Cunninghamia konishii*; *Fokienia hodginsii*	*in situ* & *ex situ*	The provincial budget; international organization support	No change
24	Ta Dung	27	69	14	None	*in situ*	The central budget; the provincial budget; international organization support; domestic organization support	Decrease
25	Than Sa - Phuong Hoang	45	57	22	On the way to apply	*in situ*	The provincial budget	Increase
26	Thuong Tien	32	39	12	*Cinnamomum parthenoxylon*; *Calamus platyacanthus*	*in situ*	The central budget; the provincial budget	Decrease
27	U Minh Thuong	2	3	1	*Hydnophytum formicarum*; *Elaeocarpus hygrophilus*	*In situ*	The central budget; the provincial budget	Decrease
28	Vu Quang	74	51	74	*Fokienia hodginsii*; *Cunninghamia konishii*	*in situ*	The provincial budget; international organization support	Increase
29	Xuan Lien	61	59	22	*Fokienia hodginsii*; *Cunninghamia konishii*; *Calocedrus macrolepis*; *Madhuca pasquieri*; *Cinnamomum parthenoxylon*;	*in situ* & *ex situ*	The provincial budget	No change
30	Xuan Nha	26	21	18	None	*in situ* & *ex situ*	The central budget; international organization support	Increase
31	Xuan Son	47	46	15	*Vatica subglabra*; *Cinnamomum balansae*; *Cinnamomum parthenoxylon*; *Ardisia silvestris*; *Melientha suavis*; *Anoectochilus calcareus*	*in situ*	The provincial budget	No change
32	Yok Don	65	85	22	*Dalbergia cochinchinensis*;	*in situ*	The provincial budget	No change

(*): 'None' indicates that they were unsure if the protected area has any conservation program of threatened species.

Appendix Question 7–10 part 1.

No		Question 7: How often does the protected area monitor the status of threatened species?	Question 8: Could you please propose threatened plant species you would prioritize to conserve, and explain your choice?	Question 9: What would you consider being the major challenges of the conservation of threatened species?	Question 10: Could you suggest any solutions for improving conservation at your protected area?
	Name of protected areas	Monitoring frequency	Some proposed species	Facing challenges	Suggestions
1	Ba Vi	No clear frequency	*Parris polyphylla*; *Anoectochilus setaceus*; *Camellia* sp.; *Amentotaxus argotaenia*; *Zingiber monophyllum*; *Stephania dielsiana* Y.C. Wu; *Carex bavicola* Raym.; *Cinnamomum balansae*; *Cephalotaxus mannii*	Climate change	Develop a long term program for conservation of threatened plant species in the national park.
2	Bach Ma	When requested; depending on available fund; no clear frequency	*Anoectochilus roxburghii*; *Paris polyphylla*; *Paphiopedilum appletonianum*; *Cinnamomum parthenoxylon*; *Cephalotaxus mannii*; *Sindora tonkinensis*; *Anoectochilus setaceus*; *Parris polyphylla*; *Camellia fleuryi, Stemona collinsae*	Climate change; High forest-dependent local people; lack of awareness of threatened species	Enhance biodiversity patrolling and monitoring, especially for endangered and rare plants; have programs to investigate the distribution and number of individuals in the wild, and implement *In situ* and / or *Ex situ* conservation methods to conserve them; propagate and raise awareness of buffer zone communities about species conservation, and have programs to support local people's livelihoods; increase remuneration for forest rangers; plan long-term activities and invest in a target program.
3	Ben En	No clear frequency	*Vatica tonkinensis* A.Chev; *Garcinia fagraeoides A.*; *Cinnamomum parthenoxylon*; *Magnolia Fordiana*	Shortage on finance and human resources	Enhance law enforcement, scientific researches; international colloborate. Attract more investment and socialize conservation.
4	Bidoup - Nui Ba	No clear frequency	*Pinus krempfii, Rhododendron*; *Camellia species*	Shortage on finance and human resources	In the long run, there is a need for comprehensive conservation programs (including biological and ecological research, breeding research, replanting and storage, monitoring, evaluation...).
5	Binh Chau - Phuong Buu	When requested; no clear frequency	*Dalbergia bariensis*; *Afzelia xylocarpa*; *Dysoxylum loureirii*; *Dipterocarpus costatus*	High forest-dependent local people; forest fire	Need more attention from the government for natural conservation (including protecting threatened plant species)
6	Bu Gia Map	When requested; depending on available fund; no clear frequency	*Dalbergia oliveri*; *Afzelia xylocarpa*; *Pterocarpus macrocarpus* Kurz; *Aquilaria crassna*; *Nervilia fordii*	High-demanding in use rare species	MARD and MONRE should consider and agree on funding for protected areas to implement inspection and monitoring programs, e.g., data collection and species conservation. Enhancing law enforcement; promoting propaganda and related regulations; Raise awareness among people, social classes, officials, and party members on the significant role of threatened plant species in the existing forest ecosystem and to the public.
7	Cat Tien	When requested; depending on available fund; no clear frequency	*Dalbergia oliveri*; *Afzelia xylocarpa*; *Pterocarpus macrocarpus*; *Camellia* sp.	Shortage on finance and human resources	Enhance law enforcement; have more training classes and propaganda activities to raise awareness; create more jobs for local people to avoid exploiting forest resources.
8	Chu Mom Ray	–	*Dysoxylum cauliflorum* Hiem; *Dalbergia cochinchinensis*; *Dalbergia oliveri*; *Cephalotaxus mannii*; *Sindora tonkinensis*	Shortage on finance and human resources	The conservation community needs more support from individuals and organizations.
9	Chu Yang Sin	When requested; no clear frequency	*Keteleeria evelyniana*	Infrastructure expanding; high forest-dependent local people	Enhance conservation capacity, such as support to conserve a specific threatened plant species.
10	Cuc Phuong	Depending on available fund	*Garcinia fagraeoides A.*; *Dysoxylum cauliflorum* Hiem; *Erythrophloeum fordii Oliv.*; *Podocarpus neriifolius*; *Parashorea chinensis*	High forest-dependent local people; shortage on finance and human resources	Strengthen investigation, monitoring, and overall evaluation of conservation; the state should provide an annual budget to preserve rare and endangered plant species.
11	Dong Chau - Khe Nuoc Trong	No clear frequency	*Anoectochilus setaceus*; *Aquilaria crassna*; *Sindora tonkinensis*; *Paphiopedilum appletonianum*; *Vatica odorata*	High forest-dependent local people	More funding and human resources to support conservation work; research and investigation programs on rare species, breeding and development of species.
12	Dong Nai	No clear frequency	*Dendrobium crepidatum*; *Coscinium fenestratum*; *Dalbergia bariensis*; *Anisoptera costata*; *Dysoxylum loureirii*; *Goniothalamus donnaiensis*	Shortage on finance and human resources	Enhancing priority policies and capital sources for implementing conservation projects; more sharing of domestic and international information; more connection and mutual support between agencies.

Appendix Question 7–10 part 2.

No		Question 7: How often does the protected area monitor the status of threatened species?	Question 8: Could you please propose threatened plant species you would prioritize to conserve, and explain your choice?	Question 9: What would you consider being the major challenges of the conservation of threatened species?	Question 10: Could you suggest any solutions for improving conservation at your protected area?
	Name of protected areas	Monitoring frequency	Some proposed species	Facing challenges	Suggestions
13	Dong Son - Ky Thuong	When requested; depending on available fund	*Codonopsis javanica*; *Parris polyphylla*	High forest-dependent local people; shortage on finance and human resources	More projects and research on conserving threatened plant species in the protected area.
14	Hoang Lien	Depending on available fund; no clear frequency	*Podocarpus neriifolius*; *Fokienia hodginsii*; *Abies delavayi* subsp. *fansipanensis*; *Amentotaxus argotaenia*; *Cephabtaxus manii*	Shortage on finance and human resources	More projects, funding, human resources and research on conserving threatened plant species in the protected area.
15	Hung King national forest	No clear frequency	*Cycas pectinata*; *Aquilaria crassna*; *Nageia fleuryi*; *Cinnamomum parthenoxylon*; *Pterocarpus macrocarpus*	Invasive species	A need of specific plans and funding for conservation.
16	Kim Hy	No clear frequency	*Anoectochilus setaceus*; *Calocedrus rupestris*; *Cinnamomum balansae*; *Stephania rotunda*; *Markhamia stipulata*	High forest-dependent local people; shortage on finance and human resources	Every five years, threatened plant species should be monitored.
17	Muong Nhe	3 years or when requested	*Fokienia hodginsii*; *Cydas* sp.; *Anoectochilus setaceus*; *Aquilaria crassna*; *Fibraurea recisa*; *Orchidaceae* spp.	High forest-dependent local people; shortage on finance and human resources; lack of awareness of threatened species	More funding for conserving threatened plant species; developing economic for buffer zone; increasing human resources; more training programs on the conservation for the staff.
18	Ngoc Son	No clear frequency	*Diospyros mun*; *Garcinia fagraeoides A.*; *Burretiodendron hsienmu*; *Fernandoa collignonii*; *Dipterocarpus retusus*	Climate change; high forest-dependent local people	Developing programs on conserving threatened plant species.
19	Phu Canh	No clear frequency	*Fokienia hodginsii*; *Calocedrus macrolepis*; *Anoectochilus setaceus*; *Parris polyphylla*; *Madhuca pasquieri*	High forest-dependent local people	None
20	Pu Hoat	No clear frequency	*Fokienia hodginsii*; *Calocedrus macrolepis*; *Anoectochilus setaceus*; *Parris polyphylla*; *Madhuca pasquieri*	Shortage on finance and human resources	Support finance for projects on conserving and developing threatened plant species in protected areas.
21	Pu Hu	Depending on available fund; no clear frequency	*Cinnamomum parthenoxylon*; *Kadsura genus*; *Calamus platyacanthus*; *Stephania* spp; *Orchidaceae* spp.	Shortage on finance and human resources; high forest-dependent local people; lack of awareness of threatened species	Ensuring investment in conservation projects for the entire species development stage; promoting *ex situ* conservation work. Train qualified and capable staff to meet the job requirements. A need for conservation programs and projects associated with improving livelihoods for people in the buffer zone.
22	Pu Luong	No clear frequency	*Dysoxylum cauliflorum*; *Cinnamomum parthenoxylon*; *Burretiodendron hsienmu*; *Magnolia conifera*	Shortage on finance and human resources	Increased funding for conservation programs; development of human resources for threatened plant species conservation; policies to attract young people to work on biodiversity conservation.
23	Pu Mat	No clear frequency	*Cunninghamia konishii*; *Fokienia hodginsii*; *Fibraurea recisa*; *Anoectochilus setaceus*; *Hopea mollissima*	Shortage on finance and human resources; high forest-dependent local people	More funding for conservation programs
24	Ta Dung	When requested; depending on available fund	*Anoectochilus roxburghii*; *Paphiopedilum villosum*; *Tacca subflabellata*; *Cinnamomum balansae*; *Paphiopedilum callosum*	Shortage on finance and human resources; invasive species	The biodiversity of Ta Dung National Park was monitored in 2012. Therefore, we recommend implementing programs and projects to investigate and update the status of biodiversity (including endangered and rare species).
25	Than Sa - Phuong Hoang	When requested; depending on available fund	*Anoectochilus setaceus*; *Burretiodendron hsienmu*; *Garcinia fagraeoides A.*; *Podocarpus neriifolius*; *Markhamia stipulata*	High forest-dependent local people	More projects to support the protected area in conserving threatened plant species (can be from MARD, DoF, VNUF, etc.)
26	Thuong Tien	No clear frequency	*Cinnamomum parthenoxylon*; *Calamus platyacanthus*; *Garcinia fagraeoides*; *Parris polyphylla*	Shortage on finance and human resources	Have more conservation programs; enhance capacity building; and allocate fund for conservation.à nguồn kịnh phí cho công tác bảo tồn
27	U Minh Thuong	When requested; depending on available fund	*Hydnophytum formicarum*; *Oryza rufipogon*; *Stephania longa*; *Elaeocarpus hygrophilus*	Shortage on finance and human resources	Enhance forest fire management and forest protection; promote propagation; and conserve genetic diversity.

Appendix Question 7–10 part 3.

No		Question 7: How often does the protected area monitor the status of threatened species?	Question 8: Could you please propose threatened plant species you would prioritize to conserve, and explain your choice?	Question 9: What would you consider being the major challenges of the conservation of threatened species?	Question 10: Could you suggest any solutions for improving conservation at your protected area?
	Name of protected areas	Monitoring frequency	Some proposed species	Facing challenges	Suggestions
28	Vu Quang	No clear frequency	*Fokienia hodginsii*; *Cunninghamia konishii*; *Manglietia dandyi*; *Michelia mediocris*; *Cycas* spp.; *Lithocarpus* spp.	Shortage on finance and human resources	More funding and human resources to support conservation programs on threatened plant species; more study the status of threatened plant species.
29	Xuan Lien	No clear frequency	*Fokienia hodginsii*; *Cunninghamia konishii*; *Podocarpus neriifolius* ; *Amentotaxus argotaenia*	High forest-dependent local people	More study the status of threatened plant species; seek a conservation fund from NGOs for Xuan Lien NR.
30	Xuan Nha	No clear frequency	*Pinus cernua*; *Cupressus funebris*; *Fokienia hodginsii*; *Calocedrus macrolepis*; *Madhuca pasquieri*	Shortage on finance and human resources; high forest-dependent local people	Continuing to investigate and evaluate the current status of threatened plant species in Xuan Nha; arrange state budget sources and seek other funding sources for conservation; improve human resources for conservation activities; raise awareness and support livelihoods for the local community.
31	Xuan Son	No clear frequency	*Vatica subglabra*; *Cinnamomum balansae*; *Cinnamomum parthenoxylon*; *Ardisia silvestris*; *Melientha suavis*; *Anoectochilus calcareus*	Shortage on finance and human resources	More funding and human resources to support conservation work; research and investigation programs on threatened plant species.
32	Yok Don	No clear frequency	*Afzelia xylocarpa*; *Dalbergia cochinchinensis*; *Dalbergia oliveri*; *Pterocarpus macrocarpus*; *Sindora tonkinensis*	Shortage on finance and human resources	More funding and human resources to support conservation programs on threatened plant species.