Alien and invasive plant species and their risk in National Parks of Vietnam

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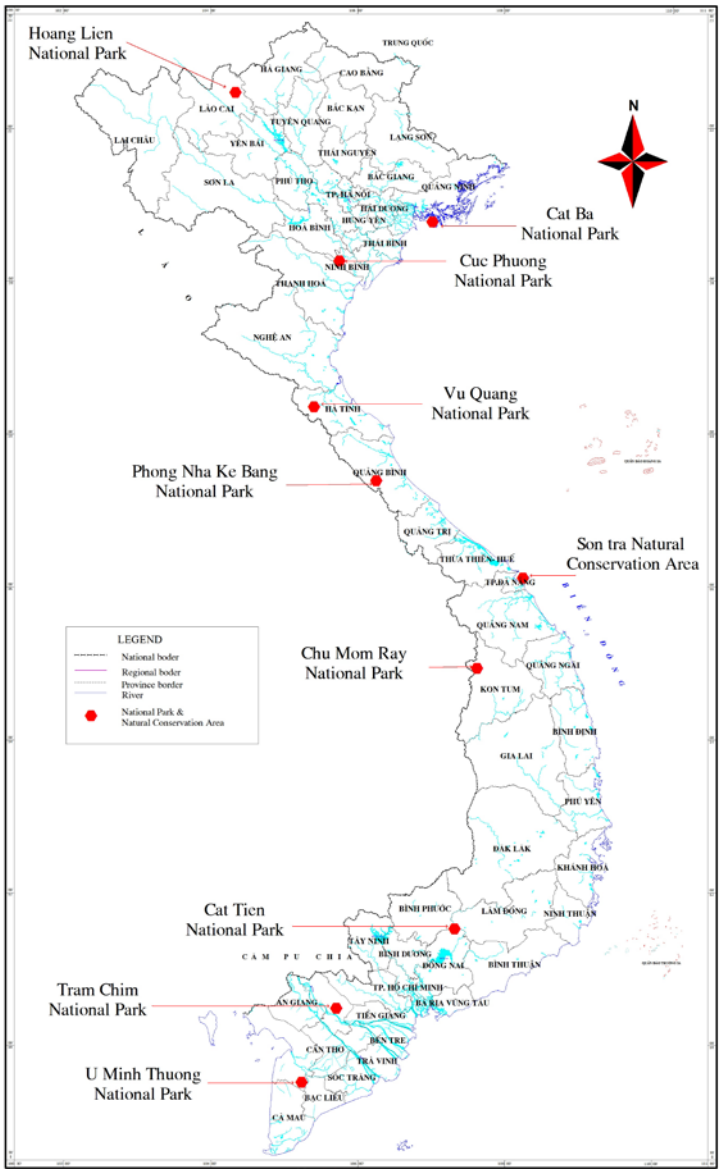
Abstract

Invasive species cause economic, or environment harm or harm to human health. They have identified elsewhere in the world, yet their introduction and effect have not documented in Vietnam yet. Of 134 alien species, 25 invasive plants species were discovered at 10 nation parks scattered through-out Vietnam. The risk of invasive species was assessed for three national parks, and their risks were different. For examples, *Chromolaena odorata* and *Mimosa diplotricha* are highest risk at Cat Ba National Park. However, *Mikania micrantha* Kunth., *Chromolaena odorata*, and *Mimosa diplotricha* cause more risk at Son Tra natural conservation area. Whilst *Mimosa pigra*, *Panicum repens*, and *Eichhornia crassipes* are significantly impact at Tram Chim National Park

Introduction

Vietnam is a tropical country where has really rich biodiversity, there are 13,766 plant species recorded, including 2,393 non-vascular plants and 11,373 vascular plants [1]. Forests provide important refugia for threatened habitats and species. The total forest areas are currently up to 13 million ha [2], including approximate 2.2 million ha (13.5%) that is planned for special-used forest [3]. According to Canh and Hai [1] forest ecological systems are being confronted with degrading not only quantity also quality Except for some weeds of agricultural lands and waterways, for example *Mimosa pigra* in the Mekong delta [4, 5], alien invasive plant species have received little attention in Vietnam. In the forest sector, research in this field is almost absent. They caused serious impacts and cost millions dollar to control, it is estimated that US$ 1.4trillion cost annually for invasive species worldwide. On the other hands, The loss of environment values caused by invasive species is considerably high up to US$ 6.8 billion in Australia; US$ 6.7 billion in Brazil; US$



25 billion in India; US$ 6.6 billion in UK; and US$ 58 billion in United States [6].

This paper reports for the first time on the alien plant species that are invasive in national parks in Vietnam. This information is essential for foresters so they can recognize the presence of alien and invasive plant species at their park, for committees of each national park to focus their priority in protecting biodiversity, and to inform managers or policy makers within the Department of Natural Conservation (Ministry of Agriculture and Rural Development) with responsibility for producing national response strategies for invasive plants

Method

10 national parks (Figure 1) were selected to survey. Transects were set up from April to September 2011 through forests and also along roads where local people usually access disturbed areas. . Species are determined to be Invasive (IAS), Likely invasive (L.IAS) or potentially invasive (P. IAS) basing on adapted criteria which were described by Massachusetts Invasive Plant Advisory Group [7] and Decision #22/2011/TT-BTNMT of Ministry of Nature Resource and Environment [8]. Assessment of the risk of invasive species at selected national parks, Cat Ba and Tram Chim, and Son Tra natural conservation area based on "An invasive species assessment protocol" method described by Morse *et al.* [9]. The risks of invasive species (I-Rank) were categorized into 4 classes, including High (H), Medium (M), Low (L), and Insignificant (I).

Results

1. Alien and invasive plant species at 10 national parks

The composition of alien and invasive plant species at 10 national parks representing for conservation forests scattered through-out Vietnam was listed, and there were totally 134 exotic weeds explored, of which 25 were classified as invasive species. Some species found in several parks whilst invasive species and their risks differed at different parks. *Chromolaena odorata* and *Mimosa diplotricha* species found colonizing at Cuc Phuong NP, Vu Quang NP, Phong Nha Ke Bang NP, Son Tra NCA, Chu Mom Ray NP Cat Tien, but they were high risk at Cat Ba NP. *Mimosa pigra* and *Eichhornia crasspies* species occurred in some parks, but they along with *Panicum repens* species highly infested at Tram Chim NP and caused serious problems there. The other hands, *Mikania mirantha* species only found at Son Tra NCA and were hig.

Site	Alien plant species	Invasive plant species
Hoang Lien NP	38	9
Cat Ba NP	38	15
Cuc Phuong NP	49	10
Vu Quang NP	49	8
Phong Nha Ke Bang NP	45	12
Son Tra NCA	53	12
Chu Mom Ray NP	52	12
Cat Tien NP	65	12
Tram Chim NP	44	12
U Minh Thuong NP	47	12
Total	134	25

2. The risk (I-Rank) of invasive alien plant species at 3 parks

The invasion by two *Mimosa* species is causing great concern in many parts of Vietnam. In particular, *M. pigra* not only invades wetland areas on the sides of rivers and canals, it can infest undisturbed swamps as well as disturbed lands such as industrial tree plantations and rice fields. In addition to impacts on biota, *M. pigra* can prevent people accessing rice fields, reduces water flow in irrigation channels keep animals from feeding areas. There is an urgent need to develop efficient methods to control and eradicate this alien species.

Family	Scientific name	Region of origin	Group	I-Rank		
				CB[1]	ST[2]	TC[3]
Asteraceae	*Ageratum conyzoides* L.	Central America	IAS	L	L	L
	Chromolaena odorata	Central America	IAS	H	H	I
	Mikania micrantha Kunth.	Central and South America	IAS		H	
	Parthenium hysteropharus L.	Central America	IAS	M		
Fabaceae	*Leucaena leucocephala* (Lamk.) De Wit	Australia	IAS	L		
	Mimosa diplotricha C. Wight ex Sauvalle	Central America	IAS	H	H	M
	Mimosa pigra L.	Mexico, Central and South America	IAS	L	M	H
	Mimosa pudica L.	Central America	IAS	L	M	L
Poaceae	*Eupatorium odoratum* L.	Central America	IAS			
Pontedriaceae	*Eichhornia crassipes* (Maret.) Solms	Brazil	IAS			H
Verbenaceae	*Lantana camara* L.	Central America	IAS	L	L	
Amaranthaceae	*Amaranthus spinosus* L.	Central America	P.IAS		L	
Araceae	*Pistia stratiotes* L.	North America	P.IAS			M
Asteraceae	*Bidens pilosa* L.	South Africa	P.IAS	I	M	
	Xanthium strumarium DC. (strumarium Auct. non L.)	Europe and America	P.IAS	L		
Cactaceae	*Opuntia stricta* Willem	America	P.IAS	I		
Convolvulaceae	*Cuscuta chenenis* Lamk.	China	P.IAS	M		L
Papaveraceae	*Argemone mecicana* L.	Europe or America	P.IAS			
Passifloraceae	*Passiflora foetida* L.	Tropical America	P.IAS	I		M
Poaceae	*Panicum repens* L.	America	L.IAS			M
Poaceae	*Pennisetum polystachyon* (L.) Schult	Africa	L.IAS		M	
Poaceae	*Phragmites australis americanus* (Saltonstall, Peterson and Soreng)	North America	P.IAS			L
Salviniaceae	*Salvinia cucullata* Roxb.	America, Africa and West Indies	P.IAS			M
Verbenaceae	*Stachytarpheta jamaicensis* (L.) Vahl	Tropical and sub-tropical America	P.IAS		I	
Zingiberaceae	*Hedychium gardnerianum* Sheppard ex Ker Gawl	Himalaya, India, Nepal, and Bhutan	P.IAS	I		

[1] Cat Ba national park; [2] Son Tra natural conservation area; [3] Tram Chim national park

Chromolaena odorata has invaded many secondary forests from North to South-east Vietnam, and was particularly evident in Cat Ba national park and Son Tra natural conservation area. This invasive species is easily dispersed and forms dense stands. It is not known when this species was introduced to Vietnam. It appears to be having a major impact similar to that described elsewhere [10] including preventing the establishment of native species. However, a detailed assessment of

the impact of this species on biodiversity and ecosystem function has yet to be carried out in Vietnam. A case study such as that undertaken in South Africa [11] should be applied in Vietnam.

A range of initiatives should be implemented to better monitor and manage invasive weeds in forests and national parks in Vietnam. Firstly, field and reference guides on the 25 invasive plant species should be produced as soon as posible using existing publications [12, 13] as a guide

In this first project, it was not possible to survey all the different topographies and vegetation types and detailed information on populations could not be obtained. The work needs to be extended using approaches defined by Rejmánek [14].

References

1. Canh, L.X.; Hai, H.T., Status and changes of biodiversity in Vietnam (in Vietnamese). In *The workshop on Biodiversity*, National Convention Centre, My Dinh, Hanoi, 2010.
2. Nhi, H.D., Decision #1828/QĐ-BNN-TCLN: Publicized forest status in 2010, Ministry of Agriculture and Rural Development. In Hanoi, 2011.
3. Lien, T.T., Assessment of planning the spcial-used forest system in Vienam (in Vietnamese). In *The workshop on Biodiversity*, National Convention Centre, My Dinh, Hanoi, Vietnam, 2010.
4. Triet, T.; Kiet, L.C.; Thi, N.T.L.; Dan, P.Q. In *The invasion of Mimosa pigra in wetlands of the Mekong Delta, Vietnam*, Research and Management of Mimosa pigra, Canberra, 2004; Julien, M.; Flanagan, G.; Heard, T.; Hennecke, B.; Paynter, Q.; Wilson, C., Eds. CSIRO: Canberra, 2004; pp. 45-51.
5. Triet, T.; Thi, N.T.L.; Storrs, M.J.; Kiet, L.C. *The value of awareness and early intervention in the management of invasive alien species: a case-study on the eradication of Mimosa pigra at the Tram Chim National Park*; Secretariat of the Convention on Biological Diversity: Montreal, 2001; pp 37-38.
6. Pimentel, D.; Zuniga, R.; Morrison D. Update on the environmental and economic costs associated with alien-invasive species in the United States. . *Ecological Economics* **2005**, *52*, 273-288.
7. MIAPG *Final report "The evaluation of non-native plant species for invasiveness in Massachusetts" Update April 1 2005*; Massachusetts Invasive Plant Advisory Group: 2005.
8. MONRE, Dicision # 22/2011/TT-BTNMT, July 1 2011. To assign criteria of invasive species and list of invasive species (in Vietnamese). In MInistry of Nature Resource and Environment, Vietnam, 2011.
9. Morse, L.E.; M., R.J.; N., B.; R., H.; S., L. *An Invasive Species Assessment Protocol: Evaluating Non-Native Plants for Their Impact on Biodiversity. Version 1*; NatureServe: NatureServe, Arlington, Virginia, 2004; pp 40.
10. Luwum, P. Control of Invasive *Chromolaena odorata*. An evaluation in some land use types in KwaZulu Natal, South Africa. Internatinal Institute for Geo-Information Science and Earth Observation: Enschede, Netherlands, Country, 2002.
11. Wilgen, B.W.V.; Richardson, D.M.; Maitre, D.C.L.; Marais, C.; Magadlela, D. The economic consequencee of alien plant invasions: Examples of impacts and approches to sustainable management in South Africa. *Environment, Development and Sustainability* **2001**, *3*, 145-168.
12. Huebner, C.D.; Olson, C.; Smith, H.C. *Invasive Plants Field and Reference Guide: An Ecological Perpective of Plant Invaders of Forests and Woodlands*; USDA: 2006; Vol. Supplement 1, pp 84.
13. Huebner, C.D.; Olson, C.; Smith, H.C. *Invasive Plants Field and Reference Guide: An Ecological Perpective of Plant Invaders of Forests and Woodlands*; USDA: 2008; Vol. Supplement 2, pp 36.
14. Rejmánek, M. Invasive plants: approaches and predictions. *Austral Ecology* **2005**, *25*, 497-506.