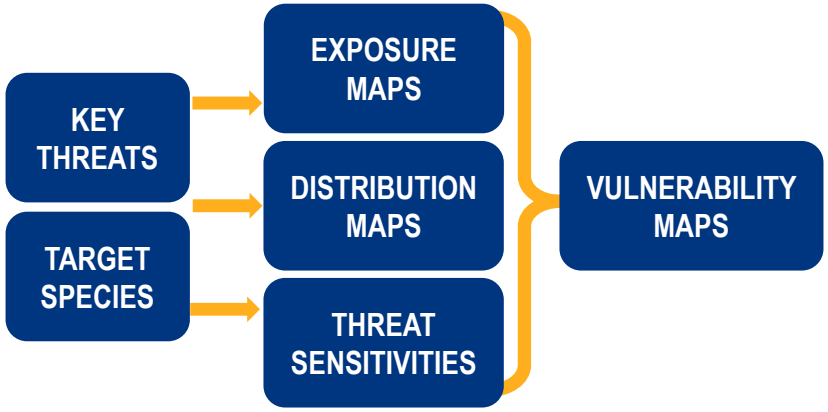
Range-wide vulnerability mapping to identify species specific priority areas for conservation and restoration

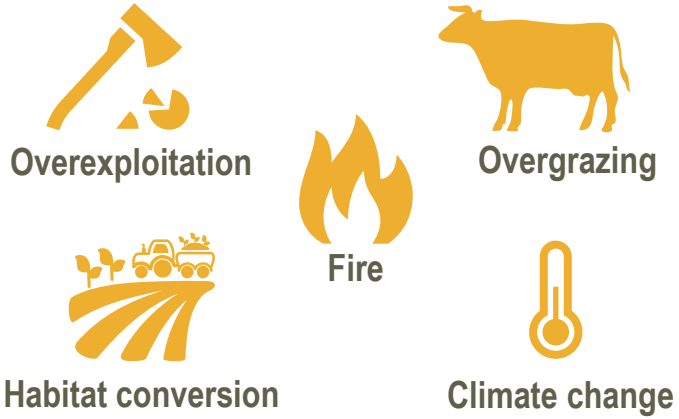
Hannes Gaisberger, Alliance Bioversity Int. and CIAT 6 December 2021, Final virtual workshop

Introduction

- **Multiple anthropogenic threats** drive local extinction of tropical tree species
- In addition to **global warming**, forest habitats in the Greater Mekong are being rapidly destroyed by **industrial-scale (illegal) logging and agricultural expansion**
- The resulting **loss of genetic diversity limits** the opportunities to **restore viable populations** and reduces the species' ability to **adapt to a changing environment**

Methods





(Gaisberger et al. 2017; Fremout et al. 2020)

Key threat	Indicators	Spatial layers
Over-exploitation	Human population density	Human population density (Landscan, 2016)
	Travel time to cities	Travel time to cities (Weiss et al., 2018)
	Presence/ absence of a protected area	Designated protected areas (UNEP-WCMC, 2016), updated with protected areas for Cambodia provided by contributing species experts
Fire	Fire frequency	NASA Fire Information for Resource Management System (FIRMS). MODIS Active Fire Detections from 2013 to 2017 (NASA EOSDIS, 2018)
Overgrazing	Cattle, goat and sheep density	Gridded Livestock of the World v2.0 (Robinson et al., 2014)
Habitat conversion	Percentage of cropland coverage	Land cover share database (GLC-SHARE, 2014)
	Percentage of planted forests and tree crops	Tree Plantations (Harris et al., 2018) for Cambodia
Climate change	Loss of suitable habitat	SDMs projected to future climate conditions (2041-2060 period) using 5 Global Circulation Models (Eyring et al., 2016) with maximized dissimilarity and three shared socio-economic pathways (SSP126, SSP245 and SSP585), downloaded from the WorldClim website

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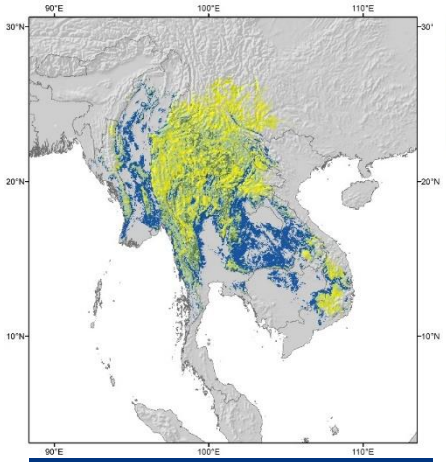
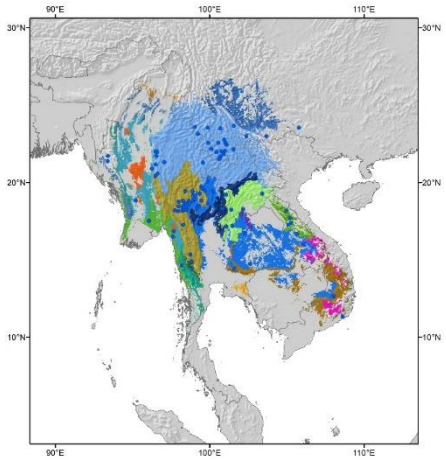
Ecoregional zoning

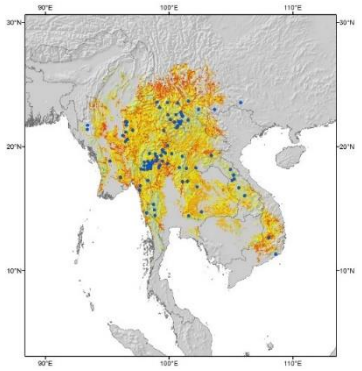


In situ conservation
Restoration activities
Ex situ conservation
No priority actions

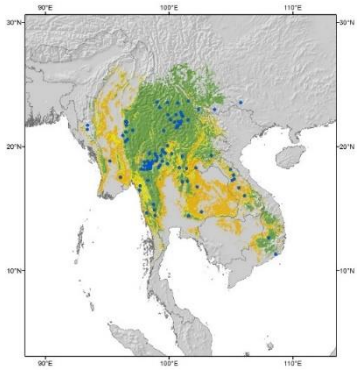
Priority areas for conservation and restoration
Dalbergia cultrata



Ecoregions presence
Dalbergia cultrata



Current threat vulnerability



Climate change vulnerability

- Based on threat levels (current threats and climate change) we identified species-specific **priority areas for conservation and restoration**
- We **subdivided** these areas **by ecoregions** (Dinerstein et al., 2017) **as surrogate for genetic diversity** to **capture adaptive variation within species**
- Ecoregions were defined as **high priority for conservation (of adaptive variation)** when **less than 10%** of the potential distribution area **was 'stable' and within protected areas = CONSERVATION TARGET**

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Results (species level)

- All three species face **significant threat levels in more than 80% of their natural range**
- **Protected areas** cover only 11-20% of the species' predicted ranges
- **Overexploitation** is the single most important threat (67-69%), followed by **fire** (31-40%) and **habitat conversion** (19-39%)
- ***Dalbergia cultrata* is severely threatened by climate change** (39%); less effects on *D. oliveri* (5%) and on *D. cochinchinensis* (0%)*

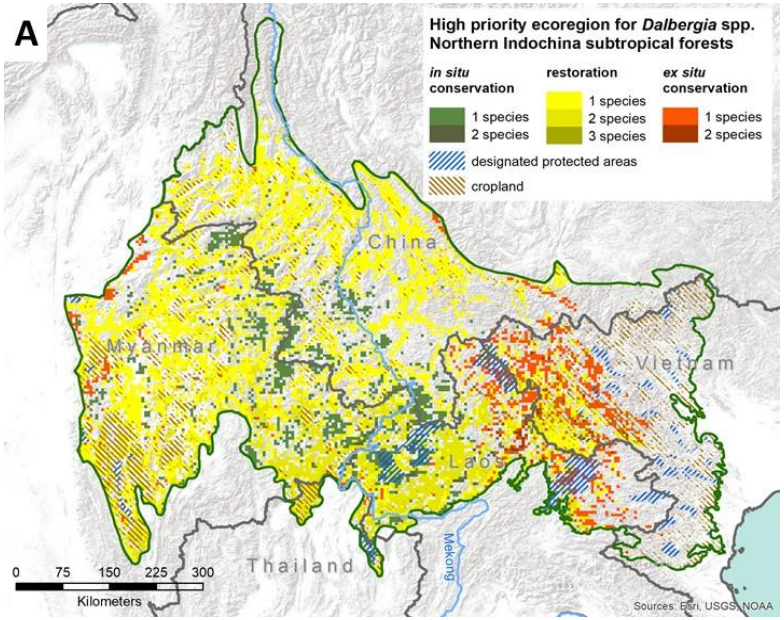
Species	Predicted suitable habitat (km^2)	Predicted suitable habitat in protected areas (%)	Prioritised for in situ (%)	Prioritised for ex situ (%)	Prioritised for restoration (%)
Siamese Rosewood *(D. cochinchinensis)*	406,332	20	10	0	56
Burma Blackwood *(D. cultrata)*	1,077,207	11	6	29	27
Burmese Rosewood *(D. oliveri)*	961,460	17	9	3	51

Proportion of suitable habitat prioritized for conservation and restoration

*Hung et al., 2020

Results (intraspecific level)

- About **half of the ecoregions** were classified as **high priority for improving the conservation of adaptive variation**
- **None of the species is sufficiently protected** within individual ecoregions in individual countries



Ecoregion	Country	Species	Predicted distribution			Priority for in situ		Priority for restoration		Priority for ex situ
			Km²	% protected	% protected and stable	% of total area	% in protected areas	% of total area	% in natural habitats	% of total area
Northern Indochina sub-tropical forests	China, Laos, Myanmar, Thailand, Vietnam	*D. cochinchinensis*	427	6	6	-	-	47	89	-
		D. cultrata	331,123	3	2	19	8	41	87	3
		D. oliveri	106,988	8	5	2	24	40	86	16

Recommendations

***IN SITU* conservation**

Additional protected areas in most suitable areas/habitats. **High genetic differentiation*** = conservation needs to **expand also in underrepresented areas to avoid loss of unique adaptations**

RESTORATION activities

Outside of the current protected area network is necessary for **recovering and maintaining adaptive variation within species** across large parts of their ranges

***EX SITU* conservation**

Focus on areas **where climate threat levels are high but current threat levels are low = likely to find viable remnant populations**

- **Spatial analysis to complement field studies** in targeting areas with **high potential for conservation and restoration** and **most synergies** between species and countries **within ecoregions**
- **Better targeting saves resources (incl. Time)** which is important in the **race against local extinctions** of *Dalbergia* spp. and other severely threatened species

For species specific vulnerability and priority action maps please visit https://www.tree-diversity.org/

*Hartvig et al., 2018

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Thank you

Hannes Gaisberger
Associate Scientist/ PhD student

h.gaisberger@cgiar.org