Supplementary Information

Article

Forest and population characteristics of vulnerable relict *Tsuga forrestii* in China

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The Supplementary file includes Tables S1–S4 and Figure S1.

Table S1 Species composition in the arborous layer of each forest type. Species with IV ≥ 0.01% are shown.

Forest type	Type 1	Type 2	Type 3	Type 4
Number of species	37	12	10	37
species	IV（%）	IV（%）	IV（%）	IV（%）
Tsuga forrestii	47.72	36.74	32.07	34.59
Rhododendron rubiginosum	5.02			
Abies forrestii	4.17		3.59	17.70
Pinus armandii	4.05		11.07	1.34
Quercus rehderiana	3.93			11.06
Abies squamata	3.60			
Pinus yunnanensis	3.33	3.67	6.94	0.67
Acer davidii	2.76		0.69	2.32
Betula utilis	2.45			2.27
Populus davidiana	2.17			0.16
Chimonobambusa sangzhiensis	1.89			
Corylus ferox	1.80			
Picea likiangensis	1.77		10.00	1.08
Betula alnoides	1.63			
Rhododendron traillianum	1.58			
Skimmia arborescens	1.42			
Populus yunnanensis	1.26			
Taxus wallichiana	1.23			
Viburnum erubescens	1.05			0.26
Cornus macrophylla	0.87			2.52
Rhododendron decorum	0.78	1.37		2.36

Pinus densata	0.70			0.50
Tilia chinensis	0.54			
Malus ombrophila	0.49			
Lindera supracostata	0.42			
Litsea pungens	0.40			0.48
Quercus guyavifolia	0.37		31.98	0.51
Skimmia reevesiana	0.35			
Osmanthus delavayi	0.35			
Abies fabri	0.29			
Salix phanera	0.28			
Acer sinense	0.27		0.75	
Actinodaphne pilosa	0.27			
Enkianthus quinqueflorus	0.22			
Olea tsoongii	0.19			
Sorbus meliosmifolia	0.19			5.85
Premna microphylla	0.17			
Lithocarpus variolosus		24.39		
Castanopsis orthacantha		15.06		
Polyspora speciosa		4.06		
Schima argentea		3.85		
Rhododendron simsii		3.52		
Ternstroemia gymnanthera		2.55		
Pseudotsuga forrestii		1.90		
Illicium simonsii		1.53		
Beilschmiedia intermedia		1.36		
Rhododendron annae			2.24	
Coriaria nepalensis			0.68	
Acer forrestii				3.39
Machilus duthiei				2.63
Enkianthus deflexus				2.56
Pinus armandi				1.69
Acer flabellatum				0.79
Eurya loquaiana				0.67
Gamblea ciliata var. *evodiifolia*				0.65
Juglans sigillata				0.64
unknown 1				0.48
Carpinus cordata				0.42
Rhododendron racemosum				0.37
Salix heterochroma				0.31
Mallotus tenuifolius				0.30
Sorbus wilsoniana				0.27
Viburnum cylindricum				0.24
Sarcococca ruscifolia				0.19
Stachyurus chinensis				0.16

Myrsine africana	0.15
Cornus kousa subsp. *chinensis*	0.14
Eleutherococcus leucorrhizus var. *setchuenensis*	0.14
p87 unknown	0.14

Table S2 Species composition in the Shrub layer of each forest type. Species with IV ≥ 0.01% are shown.

Forest type	Type 1	Type 2	Type 3	Type 4
Number of species	44	10	20	42
species	IV（%）	IV（%）	IV（%）	IV（%）
Abies forrestii	15.83		1.33	12.96
Rhododendron decorum	11.70	6.64	6.68	23.46
Tsuga forrestii	10.11		2.82	4.29
Chimonobambusa sangzhiensis	9.56			
Pinus armandii	5.12			0.93
Rhododendron rubiginosum	5.09			
Rhododendron racemosum	4.69		3.33	0.91
Sarcococca ruscifolia	4.24			3.44
Berberis julianae	3.61			2.43
Quercus guyavifolia	3.40		27.21	0.88
Taxus wallichiana	3.29			
Fargesia nitida	2.77			3.59
Abies squamata	2.05			
Osmanthus delavayi	1.79			
Enkianthus deflexus	1.38			6.58
Rhododendron rex	1.32			
Acer davidii	1.30			2.45
Populus davidiana	1.27			0.72
Malus ombrophila	1.24			
Viburnum erubescens	1.20			0.65
Cotoneaster horizontalis	1.09			4.91
Eurya impressinervis	0.84	10.90		0.28
Lonicera tangutica	0.70			0.15
Aralia elata	0.60			
Pinus yunnanensis	0.43		1.41	0.33
Rhododendron annae	0.42		3.72	
Litsea pungens	0.41			
Berberis soulieana	0.39			
Ribes tenue	0.39			2.90
Acer sinense	0.36			
Abies fabri	0.33			
Eurya loquaiana	0.32	8.50		5.57
Skimmia reevesiana	0.29			
Cornus macrophylla	0.29			0.68

Cotoneaster franchetii	0.27		1.49	
Rhododendron radendum	0.27			
Premna microphylla	0.24			
Quercus rehderiana	0.23			5.10
Cotoneaster multiflorus	0.21			
Corylus ferox	0.21			
Betula utilis	0.20			0.21
Ligustrum lucidum	0.20			
Hypericum monogynum	0.18		1.26	
Caragana microphylla	0.17			
Polyspora speciosa		18.90		
Alnus nepalensis		11.53		
Daphne papyracea		10.90		2.08
Rhododendron simsii		10.79		
Scadoxus pole-evansii		9.41		
Illicium simonsii		7.02		
Castanopsis orthacantha		5.40		
Desmodium elegans			10.87	
Fargesia spathacea			7.22	
Campylotropis delavayi			5.96	
Coriaria nepalensis			5.41	1.00
Picea likiangensis			5.29	0.91
Rosa omeiensis			3.51	0.22
Tsuga chinensis var. *forrestii*			3.06	
Populus rotundifolia var. *bonatii*			2.92	
Juniperus rigida			2.79	
Indigofera tinctoria			2.00	
Polygala arillata			1.72	
Deutzia muliensis				2.85
Myrsine africana				2.69
Sunhangia elegans				1.91
Acer forrestii				1.33
Acer flabellatum				0.45
Sorbus meliosmifolia				0.43
Terminalia franchetii				0.40
Rosa cymosa				0.40
Zanthoxylum simulans				0.38
Mallotus tenuifolius				0.32
Rosa omeiensis f. *pteracantha*				0.28
Decaisnea insignis				0.24
Debregeasia longifolia				0.21
Leptodesmia microphylla				0.17
Juglans sigillata				0.15
Pyrus pashia				0.15

Table S3 Species composition in the understory of each forest type. Species with IV ≥ 0.01% are shown.

Forest type	Type 1	Type 2	Type 3	Type 4
Number of species	85	13	24	76
species	IV（%）	IV（%）	IV（%）	IV（%）
Ainsliaea yunnanensis	15.98		4.45	6.09
Ophiopogon intermedius	7.51			
Tsuga forrestii	6.25		6.00	4.72
Fragaria moupinensis	5.53			19.05
Polystichum neolobatum	4.40	7.62	5.15	0.91
Pteris actiniopteroides	4.11		0.51	3.27
Pilea sinofasciata	3.87			1.77
Berberis julianae	3.55			0.26
Adiantum davidii	3.43			3.84
Elsholtzia ciliata	3.13		12.51	1.06
Delphinium maackianum	2.70		9.05	0.11
Gynostemma pentaphyllum	1.69			0.42
Sarcococca ruscifolia	1.54			1.74
Lepisorus thunbergianus	1.50			0.32
Fargesia nitida	1.36			0.96
Dryopteris fuscipes	1.35			1.76
Loxostigma kurzii	1.34			
Polystichum makinoi	1.33			
unknown 1	1.18			0.18
Pinus armandii	1.15			
Oxalis griffithii	1.11			
Thalictrum ichangense	1.10		3.32	1.35
Cotoneaster horizontalis	1.09			0.24
Impatiens balsamina	1.08			1.16
Acer davidii	0.93			0.14
Athyrium mackinnonorum	0.92			0.75
Galium elegans	0.88			1.07
Thalictrum javanicum	0.86			2.31
Pteris cretica	0.81	10.26		
Athyrium filix-femina	0.80			
Athyrium dissitifolium	0.77			
Selaginella labordei	0.73			
Sambucus javanica	0.72			1.04
Arisaema erubescens	0.69	3.35		3.67
Parasenecio hastatus	0.65			
Justicia procumbens	0.62			0.42
Isodon adenanthus	0.59			0.94
Ribes tenue	0.55			1.03

Geranium nepalense	0.48			0.42
Urtica mairei	0.48			
Quercus guyavifolia	0.44			
Persicaria capitata	0.43			0.15
Onychium japonicum var. *lucidum*	0.43			
Mahonia fortunei	0.42			
Rhododendron racemosum	0.42			
Impatiens apsotis	0.42			
Isodon amethystoides	0.41		0.97	0.72
Leptodesmia microphylla	0.41		1.01	
Rhododendron decorum	0.38		0.82	0.16
Plagiogyria adnata	0.35	4.66		
Galinsoga parviflora	0.34			0.22
Lespedeza cuneata	0.33			
Rhododendron annae	0.33			
Plantago asiatica	0.32			0.30
Boenninghausenia albiflora	0.32			0.53
Cyclosorus dentatus	0.31			1.28
Rubia cordifolia	0.30			0.11
Argentina leuconota	0.28		0.93	
Onychium japonicum	0.28		0.55	0.16
Coriaria nepalensis	0.28		0.51	0.34
Aconitum tanguticum	0.28			
Osmanthus delavayi	0.27			
Humulus scandens	0.23			
Myriactis nepalensis	0.23			0.19
Thalictrum aquilegiifolium var. *sibiricum*	0.21			0.91
Duchesnea indica	0.20			0.53
Rubia oncotricha	0.20			0.29
Halenia elliptica	0.20			2.85
Lonicera tangutica	0.18			
Rhododendron radendum	0.18			
Dryopteris basisora	0.16			4.23
unknown	0.15			
Anaphalis sinica	0.15			
Agrimonia pilosa	0.15			
Conandron ramondioides	0.15			0.44
Cynoglossum lanceolatum	0.14			
Pinus yunnanensis	0.13		0.83	
Gonostegia hirta	0.12			
Berberis soulieana	0.11			0.09
Smilax lebrunii	0.11			0.10
Rhododendron rex	0.11			
Myrsine africana	0.11			0.08

Oplismenus compositus	0.11	9.56		2.54
Pinus armandi	0.09			0.27
Athyrium otophorum	0.07			
Blumea balsamifera		16.57		
Rubus fockeanus		13.67		
Pilea notata		12.48		
Ainsliaea bonatii		8.63		0.58
Carex cruciata		3.87	5.15	
Begonia grandis		3.85		1.27
Phalaenopsis aphrodite		3.83		
Ageratina adenophora		1.68		
Ainsliaea latifolia			13.71	
Anemone rivularis			10.00	0.22
Arthraxon hispidus			6.82	
Viola delavayi			4.33	
Plagiogyria euphlebia			4.18	
Indigofera tinctoria			3.67	
Campylotropis delavayi			3.26	
Arisaema calcareum			1.36	
Anaphalis margaritacea			0.89	0.72
Carex breviculmis				6.60
Adiantum flabellulatum				4.67
Paris mairei				1.89
Parasenecio forrestii				1.15
Deutzia muliensis				0.86
Hydrocotyle sibthorpioides var. *batrachium*				0.66
Pteridium sp.				0.65
Picea likiangensis				0.56
Arisaema franchetianum				0.54
Impatiens quadriloba				0.47
Zanthoxylum simulans				0.27
Lespedeza chinensis				0.24
Sunhangia elegans				0.24
Hemiphragma heterophyllum				0.20
Hylodesmum podocarpum subsp. *oxyphyllum*				0.17
Goniophlebium niponicum				0.17
Balanophora fungosa				0.09
Clinopodium polycephalum				0.09
Cotoneaster franchetii				0.08
Acer sinense				0.07
Quercus rehderiana				0.07

Table S4 The significant difference among forest types in phylogenetic relatedness metrics (NRI, NTI). NRI: Net relatedness index; NTI: Nearest taxon index; T1 (Type 1): *Tsuga*

forrestii-Quercus guyayifolia evergreen coniferous and broad-leaved mixed forest; T2 (Type 2): *Tsuga forrestii-Lithocarpus variolosus-Castanopsis orthacantha* evergreen coniferous broad-leaved mixed forest; T3 (Type3): *Tsuga forrestii-Abies forrestii* evergreen coniferous forest; T4 (Type 4): *Tsuga forrestii-Quercus rehderiana* evergreen coniferous and broad-leaved mixed forest.

Forest types	NRI (p)	NTI (p)
T2-T1	0.303	0.654
T3-T1	0.234	0.869
T4-T1	0.907	0.968
T3-T2	0.772	0.552
T4-T2	0.283	0.646
T4-T3	0.228	0.917

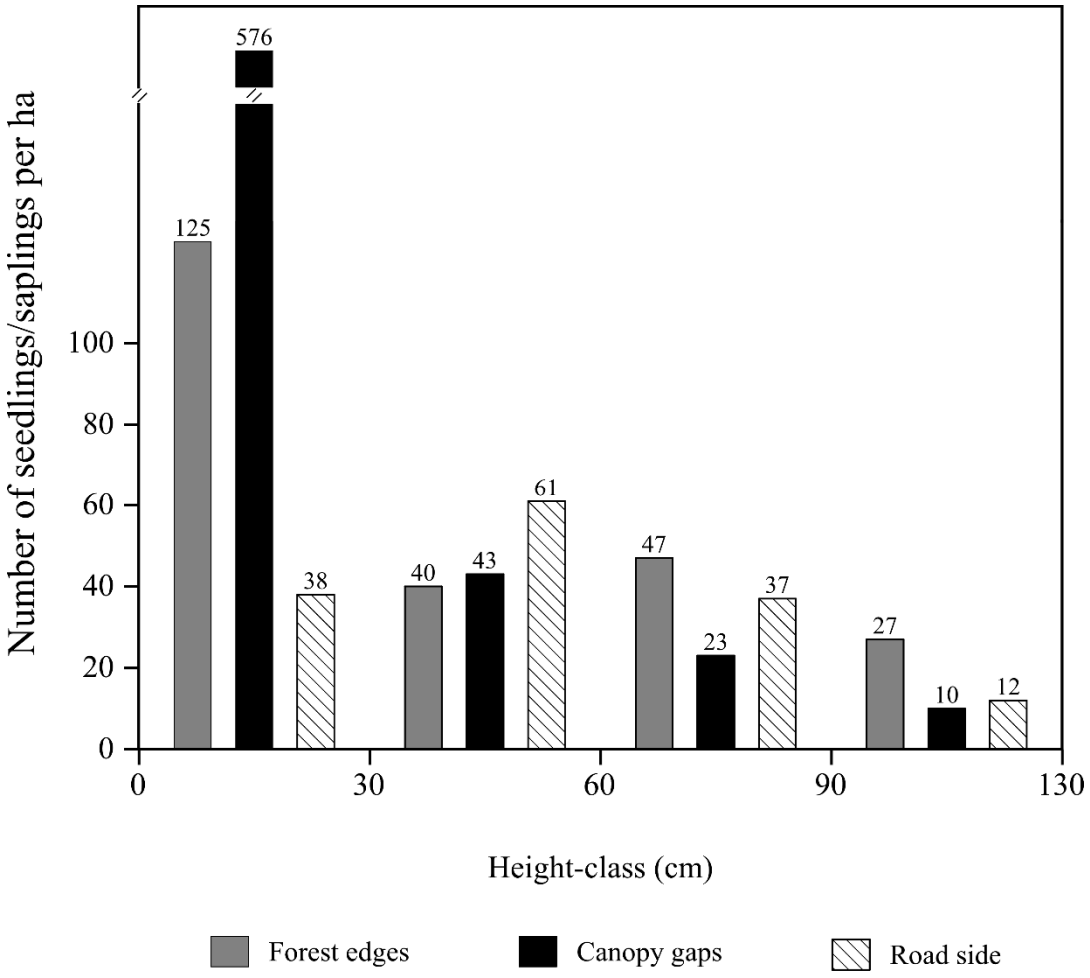


Figure S1 Density of seedlings/saplings of *Tsuga forrestii* in various micro-habitats.