

**Supporting information Notes S1** A list of 198 studies which the data were extracted for this meta-analysis.

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**Supporting information Notes S2** A list of 29 references used in the meta-analysis of the responses of soil N availability to N fertilization.

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**Supporting information Table S1** The information of the 402 species from 217 N fertilization studies in this meta-analysis.

<b>N forms</b>	<b>Study</b>	<b>Site location</b>	<b>Species name</b>		
NO <sub>3</sub> <sup>-</sup> -N	Arnawong et al. 2015	32°N, 118.77°E	<i>Sedum plumbizincicola</i>		
	Bassirad et al. 2015	41.63°N, -87°E	<i>Quercus rubra</i> L.		
		41.67°N, -87.87°E	<i>Acer saccharum</i>		
	Bjorn et al. 0.2009	57.21°N, 13.92°E	<i>Phalaris arundinacea</i>		
	Burslem et al. 1994	1.2°N, 103.5°E	<i>Dillenia suffruticosa</i>		
	De et al. al. 2004	52°N, 5.67°E	<i>Agrostis capillaris</i>		
			<i>Anthoxanthum odoratum</i>		
			<i>Campanula rotundifolia</i>		
			<i>Centaurea jacea</i>		
			<i>Festuca ovina</i>		
			<i>Festuca rubra</i>		
			<i>Lolium perenne</i>		
			<i>Plantago lanceolata</i>		
			<i>Poa trivialis</i>		
			<i>Rumex obtusifolius</i>		
			<i>Stellaria media</i>		
			Dighton et al. 2004	39.52°N, -74.29°E	<i>Pinus rigida</i>
			Drake et al.1989	39.54°N, -81°E	<i>Atriplex triangularis</i> Willd
			Eckstein & Karlsson 2001a	68.35°N, 18.8°E	<i>Calamagrostis lapponica</i>
					<i>Carex vaginata</i>
	<i>Deschampsia flexuosa</i>				
	<i>Milium effusum</i>				
	<i>Rubus saxatilis</i> L.				
	<i>Stellaria nemorum</i> L.				
	<i>Tofieldia pusilla</i>				
	<i>Salix alba</i> L.				
	Finnan J.2014	52.86°N, -6.9°E			
Green & Galatowitsch 2002	44.52°N, -93.36°E	<i>Asclepias incarnata</i> L.			
		<i>Aster spp.</i>			
		<i>Calamagrostis canadensis</i>			
		<i>Carex hystericina</i>			
		<i>Carex stricta</i> Lam.			
		<i>Eleocharis palustris</i> L.			
		<i>Eupatorium purpureum</i> L.			
		<i>Glyceria grandis</i>			
		<i>Phalaris arundinacea</i>			
		<i>Sagittaria latifolia</i> Willd.			
		<i>Sium suave</i> Walter			
		<i>Rumex obtusifolius</i>			
Hatcher et al. 1997a	54°N, -2.77°E				
He et al. 2016	38.9°N, 117.13°E	<i>Amaranthus retroflexus</i>			
		<i>Eclipta prostrata</i>			

	Kou et al. 2015	26.74°N, 115°E	<i>Flaveria bidentis</i>
	Lappalainen et al. 2000	60.45°N, 22.28°E	<i>Pinus elliottii</i>
	Loveland & Ungar 1983	40.57°N, -81.47°E	<i>Betula pubescens</i>
			<i>Atriplex triangularis</i> Willd
			<i>Hordeum jubatum</i>
			<i>Salicornia europaea</i>
	Nordin et al. 2006	64.14°N, 19.46°E	<i>Dicranum flexuosa</i>
			<i>Vaccinium myrtillus</i>
			<i>Vaccinium vitis-idaea</i>
	Portsmouth & Niinemets 2006b	59.23°N, 24.42°E	<i>Betula pendula</i>
			<i>Betula pubescens</i>
	Ronnenberg et al. 2011	43.6°N, 103.77°E	<i>Agropyron cristatum</i>
			<i>Artemisia frigida</i> Willd.
			<i>Stipa krylovii</i>
	Shevtsova et al. 2005	65.3°N, 19°E	<i>Empetrum hermaphroditum</i>
	Stevens et al. 2014	54°N, -2.78°E	<i>Anthoxanthum odoratum</i>
			<i>Plantago lanceolata</i>
			<i>Prunella vulgaris</i>
NH <sub>4</sub> <sup>+</sup> -N	Arnamwong et al. 2015	32°N, 118.77°E	<i>Sedum plumbizincicola</i>
	Arp et al. 1998	52.58°N, 5.4°E	<i>Arrhenatherum elatius</i>
			<i>Calluna vulgaris</i>
			<i>Erica tetralix</i>
			<i>Molinia caerulea</i>
			<i>Rumex obtusifolius</i>
			<i>Vaccinium myrtillus</i>
	Bazzaz et al. 1993	42.37°N, -71.8°E	<i>Acer pensylvanicum</i>
			<i>Acer rubrum</i> L.
			<i>Betula alleghaniensis</i>
			<i>Betula populifolia</i>
			<i>Fraxinus americana</i> L.
			<i>Quercus rubra</i> L.
	Burslem et al. 1994	1.2°N, 103.5°E	<i>Dillenia suffruticosa</i>
	Caporn et al. 1999	53.42°N, 1.73°E	<i>Pteridium aquilinum</i>
	Christie et al. 1982	40.57°N, -105°E	<i>Agropyron smithii</i>
			<i>Bouteloua curtipendula</i>
	Darby et al. 2008	29.25°N, -91.35°E	<i>Spartina alterniflora</i>
	DeLaune et al. 1986	29.48°N, -90.33°E	<i>Panicum hemitomom</i>
	Fowler et al. 2015	39°N, -79.67°E	<i>Betula lenta</i>
			<i>Liriodendron tulipifera</i>
			<i>Prunus pensylvanica</i>
			<i>Prunus serotina</i>
	Fridley et al. 2003	42.31°N, -71.49°E	<i>Achillea millefolium</i>
			<i>Amaranthus hypochondriacus</i>

		<i>Borago officinalis</i>	
		<i>Calendula officinalis</i>	
		<i>Fagopyrum esculentum</i>	
		<i>Linum usitatissimum</i>	
		<i>Satureja hortensis</i>	
Frost et al. 2009	31.3°N, -81.3°E	<i>Zizaniopsis miliacea</i>	
Gerdol et al. 2002	44°N, 10.6°E	<i>Empetrum hermaphroditum</i>	
		<i>Vaccinium myrtillus</i>	
		<i>Vaccinium uliginosum</i>	
Gough et al. 2004	35°N, -79°E	<i>Pinus taeda</i>	
He et al. 2016	38.9°N, 117.13°E	<i>Amaranthus retroflexus</i>	
		<i>Eclipta prostrata</i>	
		<i>Flaveria bidentis</i>	
Jean-paul et al. 2008	-23°N, -48.63°E	<i>Eucalyptus saligna</i>	
Johnson et al. 1997	43.94°N, -115.95°E	<i>Pinus ponderosa</i>	
Jourdan et al. 2008	-23°N, -48.63°E	<i>Eucalyptus saligna</i>	
Kathleen et al. 2001	21.3°N, -157.8°E	<i>Metrosideros polymorpha</i>	
Ket et al. 2011	31.33°N, -81.48°E	<i>Zizaniopsis miliacea</i>	
Kou et al. 2015	26.74°N, 115°E	<i>Pinus elliotii</i>	
LeJeune et al. 2001	39.74°N, 104.98°E	<i>Centaurea diffusa</i>	
Mäkipää R 1995	64°N, 26°E	<i>Dicranum polysetum</i>	
		<i>Pleurozium schreberi</i>	
Maurer et al. 2002	47.5°N, 80.5°E	<i>Phalaris arundinacea</i>	
Nordin et al. 2006	64.14°N, 19.46°E	<i>Dicranum flexuosa</i>	
		<i>Vaccinium myrtillus</i>	
		<i>Vaccinium vitis-idaea</i>	
Oliet et al. 2005	36.51°N, -2.2°E	<i>Acacia salicina</i>	
Shevtsova et al. 2005	65.3°N, 19°E	<i>Empetrum hermaphroditum</i>	
Son et al. 2003	37.5°N, 127.7°E	<i>Larix leptolepis</i>	
Stevens et al. 2014	54°N, -2.8°E	<i>Anthoxanthum odoratum</i>	
		<i>Plantago lanceolata</i>	
		<i>Prunella vulgaris</i>	
Tang et al. 2004	31.29°N, -92.46°E	<i>Pinus taeda</i>	
Tomassen et al. 2003	51.32°N, 6.1°E	<i>Betula pubescens</i>	
		<i>Molinia caerulea</i>	
Tomassen et al. 2004	53.2°N, -7.6°E	<i>Molinia caerulea</i>	
Tyler et al. 2003	38.5°N, -75.7°E	<i>Spartina alterniflora</i>	
Vose et al. 1995	39°N, -121°E	<i>Pinus ponderosa</i>	
Yujie et al. 2014	36.43°N, 117.45°E	<i>Quercus acutissima</i>	
		<i>Robinia pseudoacacia</i>	
Zhang et al. 2011	43.63°N, 116.7°E	<i>Caragana microphylla</i> Lam.	
Zhang et al. 2016	44.62°N, 88.26°E	<i>Syntrichia caninervis</i>	
Zhang 2010	43.63°N, 116.7°E	<i>Leymus chinensis</i>	
CO(NH <sub>2</sub> ) <sub>2</sub>	Anderson et al. 1998	36°N, -86.8°E	<i>Claytonia virginica</i> L.



Arnambwong et al. 2015	30°N, 120°E	<i>Sedum plumbizincicola</i>
Bai et al. 2009	42°N, 116°E	<i>Leymus chinensis</i>
Barger et al. 2002	10.3°N,-66.56°E	<i>Axonopus canescen</i>
		<i>Trachypogon plumosus</i>
		<i>Melinis minutiflora</i>
Bonanomi et al. 2006	43.2°N, 13°E	<i>Brachypodium rupestre</i>
Bowman et al. 1993	40°N, -105°E	<i>Carex scopulorum</i>
		<i>Kobresia myosuroides</i>
Boyer et al. 1999	32.4°N, -122.5°E	<i>Sarcocornia pacifica</i>
Cahill et al. 1999	34.704°N, -81.214°E	<i>Abutilon theophrasti</i>
Frost et al. 2009	51.5°N, -0.21°E	<i>Zizaniopsis miliacea</i>
Funk et al. 2008	19.47°N, -155.27°E	<i>Acacia koa</i>
		<i>Deschampsia nubigena</i>
		<i>Eragrostis variabilis</i>
		<i>Holcus lanatus</i>
		<i>Leucaena leucocephala</i>
		<i>Metrosideros polymorpha</i>
		<i>Paspalum urvillei</i>
		<i>Psidium cattleianum</i>
Gargano et al. 2001	42.31°N, -71.49°E	<i>Eragrostis curvula</i>
Gerdol et al. 2002	44.08°N, 10.6°E	<i>Empetrum hermaphroditum</i>
		<i>Vaccinium myrtillus</i>
		<i>Vaccinium uliginosum</i>
Gough et al. 1998	39.54°N, -74.55°E	<i>Sagittaria lancifolia</i>
		<i>Scirpus americanus</i>
		<i>Spartina patens</i>
Graciano et al. 2005	-34.9°N, -57.95°E	<i>Eucalyptus grandis</i>
Guo et al. 2016	41.85°N, 124.9°E	<i>Larix kaempferi</i>
		<i>Larix olgensis</i>
Iversen et al. 2010	46°N, -89°E	<i>Alnus rugosa</i>
		<i>Calamagrostis canadensis</i>
		<i>Carex oligosperma</i>
		<i>Chamaedaphne calyculata</i>
Jaramillo et al. 1992	41°N, 104°E	<i>Agropyron smithii</i>
Ji et al. 2011	39.03°N, -82.63°E	<i>Panicum Virgatum L.</i>
	41.23°N, -83.76°E	<i>Panicum Virgatum L.</i>
Kercher et al. 2004	42°N, -105°E	<i>Phalaris arundinacea</i>
Khurana et al. 2004	25.18°N, 83.03°E	<i>Acacia nilotica L.Delile</i>
		<i>Albizia procera (Roxb.) Benth</i>
		<i>Phyllanthus emblica L.</i>
		<i>Terminalia arjuna</i>
		<i>Terminalia chebula</i>
Kummerow et al. 1982	-33.04°N, -71°E	<i>colliguaya odorifera (Mol.)</i>
		<i>cryptocarya alba</i>

		<i>lithraea caustica</i>
		<i>trevoa trinervis</i> Miers.
Ledgard et al. 2001	-37.8°N, 175.3°E	<i>Trifolium repens</i>
Liu et al. 2016	23°N, 113.3°E	<i>Cynodon dactylon</i>
Manninen et al. 2009	66°N, 27°E	<i>Deschampsia flexuosa</i>
		<i>Vaccinium myrtillus</i>
Manninen et al. 2011	69°N, 20.48°E	<i>Deschampsia flexuosa</i>
		<i>Empetrum hermaphroditum</i>
		<i>Linnaea borealis</i>
		<i>Trientalis europaea</i>
		<i>Vaccinium myrtillus</i>
		<i>Vaccinium vitis-idaea</i>
Matsushima et al. 2006	54.07°N, -115.5°E	<i>Calamagrostis canadensis</i>
Mead et al. 2008	49°N, -123.9°E	<i>Pseudotsuga menzeisii</i>
Naidoo et al. 2009	-28.8°N, 32°E	<i>Avicennia marina</i>
Onipchenko et al. 2012	43.45°N, 41.68°E	<i>Hedysarum caucasicum</i>
		<i>Pedicularis nordmanniana</i>
		<i>Sibbaldia procumbens</i>
		<i>Vaccinium vitis-idaea</i>
Parsons et al. 1997	32.6°N, -117°E	<i>Cordylanthus maritimus</i>
Pieters et al. 1997	8.53°N, -67.19°E	<i>Hyparrhenia rufa</i>
Ren et al. 2011	42°N, 116.28°E	<i>Agropyron cristatum</i>
		<i>Cleistogenes squarrosa</i>
		<i>Melilotoides ruthenica</i>
		<i>Potentilla tanacetifolia</i>
		<i>Stipa krylovii</i>
Rickey et al. 2004	37.8°N, -89°E	<i>Phragmites australis</i>
		<i>Spartina pectinata</i>
	40.21°N, -89.08°E	<i>Phragmites australis</i>
		<i>Spartina pectinata</i>
Ryan et al. 2004	19.5°N, -155.7°E	<i>Eucalyptus saligna</i>
Ryan et al. 2012	38°N, -122.81°E	<i>Distichlis spicata</i>
		<i>Jaumea carnosa</i>
		<i>Sarcocornia pacifica</i>
Shujauddin et al. 2003	10.13°N, 76.13°E	<i>Ailanthus triphysa</i>
Simms et al. 1985	35°N, -77.056°E	<i>Lyonia lucida</i>
Sun et al. 2016	42.42°N, 117.25°E	<i>Larix Principis-rupprechtii</i>
Tischer et al. 2015	3.93°N, 79°E	<i>Setaria sphacelata</i>
Tripathi et al. 2014	25.3°N, 83.05°E	<i>Acacia catechu</i>
		<i>Bridelia retusa</i>
		<i>Dalbergia sissoo</i>
		<i>Lagerstroemia parviflora</i>
		<i>Terminalia arjuna</i>
Verma et al. 2015	24.3°N, 83°E	<i>Achyranthes aspera</i>

		<i>Ageratum conyzoides</i> L.
		<i>Anisomeles ovata</i> R. Br.
		<i>Atylosia marmorata</i> Benth.
		<i>Cayratia trifolia</i> L.
		<i>Clerodendrum indicum</i> L.
		<i>Commelina benghalensis</i> L.
		<i>Cynodon dactylon</i>
		<i>Dichanthium annulatum</i>
		<i>Digitaria sanguinalis</i> L.
		<i>Herpestis monniera</i> Kunth.
		<i>Oplismenus burmannii</i> Retz.
		<i>Panicum psilopodium</i> Trin.
	Vitousek et al. 1983	<i>Ambrosia artemisiifolia</i>
	Wang et al. 2010	<i>Kobresia humilis</i>
		<i>Pinus tabuliformis</i>
	Wang et al. 2014	<i>Stipa purpurea</i>
		<i>Kobresia pygmaea</i>
		<i>Pinus tabulaeformis</i>
	Wang et al. 2015	<i>Kobresia humilis</i>
	Wu et al. 2004	<i>Brassica juncea</i> L.
NH <sub>4</sub> NO <sub>3</sub>	Aerts et al. 1992a	<i>Sphagnum balticum</i>
		<i>Sphagnum magellanicum</i>
	Aerts et al. 1992b	<i>Carex Diandra</i>
		<i>Carex lasiocarpa</i>
		<i>Carex rostrata</i>
		<i>Carex acutiformis</i>
		<i>Carex acutiformis</i>
	Aerts et al. 1994	<i>Carex diandra</i> Schrank
		<i>Carex rostrata</i>
	Aerts et al. 2001	<i>Sphagnum magellanicum</i>
		<i>Sphagnum balticum</i>
	Baez et al. 2007	<i>Bouteloua eriopoda</i>
		<i>Bouteloua gracilis</i>
	Bardgett et al. 1999	<i>Agrostis capillaris</i>
		<i>Festuca rubra</i>
		<i>Holcus lanatus</i>
	<i>Lolium perenne</i>	
Belanger et al. 2000	<i>Medicago sativa</i>	
Bennett et al. 2003	<i>Thuja plicata</i>	
	<i>Tsuga heterophylla</i>	
Bergamini et al. 2002	<i>Callierygonella cuspidata</i>	
Blanke et al. 2005	<i>Artemisia vulgaris</i> L.	
Blanke et al. 2011	<i>Artemisia vulgaris</i> L.	
	<i>Bromus japonicus</i>	

		<i>Picris hieracioides</i>
		<i>Poa compressa</i>
Bowman et al. 2006	40.01°N, -105.31°E	<i>Kobresia myosuroides</i>
Bragazza et al. 2012	46.35°N, 11.73°E	<i>Calluna vulgaris</i>
		<i>Eriophorum vaginatum</i>
		<i>Sphagnum fuscum</i>
Briggs et al. 1991	40°N, 75.14°E	<i>Lotus corniculatus</i> L.
Brooks et al. 2003	35°N, -117°E	<i>Bromus rubens</i>
		<i>Erodium cicutarium</i>
		<i>Schismus</i> spp.
Bubier et al. 2011	45.67°N, -75.83°E	<i>Chamaedaphne calyculata</i>
		<i>Ledum groenlandicum</i>
		<i>Vaccinium myrtilloides</i>
Burslem 1994	1.3°N, 103.83°E	<i>Dillenia suffruticosa</i>
Chapin 985	68.27°N, -149.22°E	<i>Carex bigelowii</i>
		<i>Eriophorum vaginatum</i>
		<i>Rubus chamaemorus</i>
		<i>Betula nana</i>
		<i>Cassiope tetragona</i>
		<i>Empetrum nigrum</i>
		<i>Ledum palustre</i>
		<i>Polygonum bistorta</i>
		<i>Salix pulchra</i>
		<i>Vaccinium uliginosum</i>
		<i>Vaccinium vitis-idaea</i>
		<i>Betula nana</i>
Clemmensen 2006	68.63°N, 20.85°E	<i>Betula nana</i>
Cobb et al. 2008	31.38°N, -81.72°E	<i>Pinus elliottii</i>
		<i>Pinus taeda</i>
		<i>Platanus occidentalis</i> L.
		Sweetgum
Concilio et al. 2013	37.6°N, 118.82°E	<i>Bromus tectorum</i> L.
Daapp et al. 2000	47.22°N, 8.32°E	<i>Lupinus perennis</i>
De Valpine et al, 2001	38.9°N, -107.02°E	<i>Erigeron speciosus</i>
		<i>Helianthella</i>
Defoliart et al. 1988	64.51°N, -147.43°E	<i>Eriophorum vaginatum</i>
DeMarco et al. 2014	68.63°N, -149.63°E	<i>Betula nana</i>
		<i>Poa arctica</i>
		<i>Potentilla fruticosa</i>
		<i>Salix glauca</i>
		<i>Salix pulchra</i>
		<i>Valeriana capitata</i>
Ding et al. 2012	36.43°N, 117.45°E	<i>Robinia pseudoacacia</i>
Du et al. 2014	50.93°N, 121.5°E	<i>Rhytidium rugosum</i>

Dziedek 2016	53.2°N, 10.4°E	<i>Fagus sylvatica</i>
Falk et al. 2010	53.25°N, 9.97°E	<i>Molinia caerulea</i>
Fan 2013	44.25°N, 87.83°E	<i>Nepeta micrantha</i>
Friedrich et al. 2012	53.2°N, 10.4°E	<i>Molinia caerulea</i>
Fritz et al. 2012	-54.75°N, -68.33°E	<i>Sphagnum moss</i>
Fusaro et al. 2017	41.9°N, 12.5°E	<i>Fraxinus ornus</i> <i>Quercus ilex</i>
Garten et al. 2011	35.93°N, -88.72°E	<i>Panicum Virgatum</i> L.
Gebauer et al. 1987	/	<i>Avena sativa</i> <i>Hordeum vulgare</i> <i>Panicum crus-galli</i> <i>Panicum miliaceum</i>
Gerdol 2006	46.43°N, 11.4°E	<i>Sphagnum papillosum</i>
Gleeson et al. 2003	39.37°N, -74.52°E	<i>Pinus echinata</i>
Gloser et al. 2000	47.12°N, 8.41°E	<i>Lolium perenne</i>
Gough et al. 2003	68.63°N, -149.6°E	<i>Arctostaphylos alpina</i> <i>Carex bigelowii</i> <i>Cassiope tetragona</i> <i>Dryas integrifolia</i> <i>Eriophorum vaginatum</i> <i>Salix reticulata</i> <i>Tomenthypnum nitens</i> <i>Vaccinium uliginosum</i>
Grunzweig et al. 2003	31.35°N, 34.85°E	<i>Aegilops kotschy</i> <i>Bromus fasciculatus</i> <i>Carrichtera annua</i> L. <i>Crithopsis delileana</i> <i>Daucus subsessilis</i> <i>Hedypnois cretica</i> <i>Hymenocarpus circinnatus</i> L. <i>Medicago minima</i> L. <i>Medicago truncatula</i> <i>Scabiosa porphyroneura</i> <i>Stipa capensis</i> <i>Trifolium campestre</i>
Gundale et al. 2014	64.23°N, 19.77°E	<i>Deschampsia flexuosa</i> <i>Picea abies</i> <i>Vaccinium myrtillus</i>
Gunnarsson et al. 2000	57°N, 14.55°E	<i>Sphagnum fuscum</i> <i>Sphagnum rubellum</i>
	61°N, 13.57°E	<i>Sphagnum fuscum</i> <i>Sphagnum rubellum</i>
Gunnarsson et al. 2004	64.11°N, 19.33°E	<i>Sphagnum balticum</i>
Guo et al. 2014	36.43°N, 117.45°E	<i>Acer truncatum</i>

Haettenschwiler et al. 1998	46.95°N, 7°E	<i>Picea abies</i>
Han 2011	38.78°N, 110.37°E	<i>Lespedeza davurica</i> Schindl <i>Stipa bungeana</i> Trin.
Hartley et al. 1999	56.92°N, -2.58°E	<i>Calluna vulgaris</i> <i>Nardus stricta</i>
He et al. 2011	39.9°N, 116.6°E	<i>Bromus tectorum</i> L.
Hebeisen et al. 1997	47.27°N, 8.41°E	<i>Lolium perenne</i> <i>Trifolium repens</i>
Heijmans et al. 2001	52.81°N, 6.41°E	<i>Drosera rotundifolia</i> L. <i>Erica tetralix</i> <i>Eriophorum angustifolium</i> <i>Vaccinium oxycoccus</i> <i>Eriophorum angustifolium</i>
Heisler et al. 2004	39.05°N, -96.35°E	<i>Cornus drummondii</i>
Henry et al. 2015	43.02°N, 81.2°E	<i>Bromus inermis</i> <i>Poa pratensis</i>
Hobbie et al. 2005	68.63°N, -149.71°E	<i>Andromeda polifolia</i> <i>Arctostaphylos alpina</i> <i>Betula nana</i> <i>Carex bigelowii</i> <i>Carex membranacea</i> <i>Carex</i> spp. <i>Carex vaginata</i> <i>Cassiope tetragona</i> <i>Dryas integrifolia</i> <i>Empetrum nigrum</i> <i>Equisetum</i> spp. <i>Eriophorum angustifolium</i> <i>Eriophorum vaginatum</i> <i>Ledum palustre</i> <i>Polygonum bistorta</i> <i>Rhododendron lapponicum</i> <i>Rubus chamaemorus</i> <i>Salix arctica</i> <i>Salix pulchra</i> <i>Salix reticulata</i> <i>Vaccinium uliginosum</i>
Holub et al. 2010	49.5°N, 18.32°E	<i>Athyrium distentifolium</i>
Holub et al. 2012	49.2°N, 16.57°E	<i>Brachypodium pinnatum</i> <i>Bromus inermis</i> <i>Calamagrostis epigejos</i>
	48.82°N, 16.01°E	<i>Arrhenatherum elatius</i> <i>Calamagrostis epigejos</i>
Huang et al. 2015	23°N, 113.3°E	<i>Acmena acuminatissima</i>

Jackson & Reynolds 1996	39.4°N, -122.2°E	<i>Castanopsis hystrix</i> <i>Ormosia pinnata</i> <i>Schima superba</i> <i>Syzygium hancei</i> <i>Avena fatua</i> <i>Bromus hordeaceus</i> <i>Lasthenia californica</i> <i>Lolium multiflorum</i> <i>Plantago erecta</i> <i>Vulpia microstachys</i>
Ji et al. 2015	39.03°N, 82.63°E	<i>Panicum Virgatum</i> L. <i>Panicum Virgatum</i> L.
Jia et al. 2010	45.5°N, 127.5°E	<i>Fraxinus mandshurica</i> <i>Larix gmelinii</i>
Joel et al. 2001	37.24°N, -122.14°E	<i>Bromus hordeaceus</i> <i>Lasthenia californica</i> <i>Lotus wrangelianus</i> <i>Nassella pulchra</i> <i>Plantago erecta</i> <i>Vulpia microstachys</i>
Johansson M 2000	56.28°N, 8.54°E	<i>Calluna vulgaris</i>
Johnson et al. 1994	38.44°N, -120.44°E	<i>Pinus ponderosa</i>
Johnson et al. 2003	35.2°N, -111.63°E	<i>Achillea millefolium</i> <i>Agropyron repens</i> <i>Andropogon gerardii</i> Vieman <i>Berteroa incana</i> <i>Bouteloua gracilis</i> <i>Heliopsis beliantboides</i> L. <i>Koeleria cristata</i> Pers <i>Lespedeza capitata</i> <i>Lupinus perennis</i> <i>Poa pratensis</i> <i>Salsola kali</i> <i>Scbizachyrium scoparium</i> <i>Solidago rigida</i>
Kastl et al. 2015	48.5°N, 11.47°E	<i>Dactylis glomerata</i> <i>Festuca rubra</i>
Kern et al. 2004	45.63°N, -89.4°E	<i>Populus deltoides</i>
Kinugasa et al. 2012	47°N, 105.95°E	<i>Artemisia adamsii</i> <i>Salsola collina</i>
Kool 2009	52.82°N, 6.42°E	<i>Calluna vulgaris</i> <i>Eriophorum vaginatum</i> <i>Rhynchospora alba</i> L. <i>Vaccinium oxycoccus</i>

Lawrence et al. 2001	1.27°N, 116.9°E	<i>Macaranga gigantea</i> <i>Melicope glabra</i> <i>Peronema canescens</i> <i>Persea rimosa</i>
Leith et al. 1999	55.55°N, -3.1°E	<i>Erica cinerea</i> <i>Eriophorum vaginatum</i> <i>Nardus stricta</i> <i>Vaccinium vitis-idaea</i>
Liberloo et al. 2004	42.4°N, 11.8°E	<i>Populus alba</i> <i>Populus nigra</i>
Limpens et al. 2003a	52.8°N, 6.4°E	<i>Drosera rotundifolia</i> L. <i>Erica tetralix</i> <i>Eriophorum angustifolium</i> <i>Molinia caerulea</i> <i>Rhynchospora alba</i> L. <i>Vaccinium oxycoccus</i>
Limpens et al. 2004	52.7°N, 7°E 53.3°N, 7.6°E	<i>Sphagnum papillosum</i> <i>Sphagnum papillosum</i>
Liu 2011	31.68°N, 103.88°E	<i>Picea asperata</i>
Loveland et al. 1983	40.95°N, -81.8°E	<i>Atriplex triangularis</i> Willd <i>Hordeum jubatum</i> <i>short Salicornia europaea</i> <i>tall Salicornia europaea</i>
Lowe et al. 2003	40.57°N, -105°E	<i>Bouteloua gracilis</i>
Maes et al. 2014	/	<i>Milium effusum</i>
Magill et al. 2004	42.5°N, -71.1°E	<i>Pinus resinosa</i> <i>Quercus velutina</i> Lam.
Malmer N 2003	56.55°N, 15.3°E	<i>Narthecium ossifragum</i> <i>Sphagnum</i>
Manning et al. 2008	51.41°N, -0.61°E	<i>Matricaria discoidea</i> <i>Matricaria recutita</i> <i>Papaver dubium</i> <i>Senecio vulgaris</i> <i>Solanum nigrum</i> <i>Sonchus asper</i> <i>Viola arvensis</i>
Mao et al. 2014	43.01°N, 141.63°E	<i>hybrid larch</i>
McWhirter et al. 2015	43°N, -81.22°E	<i>Elaeagnus umbellata</i> <i>Fraxinus americana</i> L. <i>Malus coronaria</i> <i>Rhamnus cathartica</i> <i>Rhus typhina</i> L.
Mei et al. 2010	45.4°N, 127.5°E	<i>Fraxinus mandshurica</i> <i>Larix gmelinii</i>



Mo et al. 2008	23.17°N, 113°E	<i>Cryptocarya concinna</i> <i>Schima superba</i>
Nagakura et al. 2008	35°N, 140°E	<i>Chamaecyparis obtusa</i> <i>Cryptomeria japonica</i>
Newman et al. 2003	37.7°N, -89.2°E	<i>Festuca arundinacea</i>
Noguchi et al. 0.2013	36.17°N, 140.22°E	<i>Cryptomeria japonica</i>
Nordin et al. 1998	64.23°N, 19.78°E	<i>Deschampsia flexuosa</i> <i>Dicranum majus Sm.</i> <i>Pleurozium schreberi</i> <i>Vaccinium myrtillus</i> <i>Vaccinium vitis-idaea</i>
Øien 2004	62.67°N, 11.83°E	<i>Carex panicea</i> <i>Molinia caerulea</i> <i>Succisa pratensis.</i> <i>Thalictrum alpinum</i>
Pakeman et al. 1991	52.54°N, -4.06°E	<i>Salsola kali</i>
Pan et al. 2011	43.63°N, 117°E	<i>Achnatherum sibiricum</i> <i>Agropyron cristatum</i> <i>Artemisia frigida Willd.</i> <i>Axyris amaranthoides</i> <i>Carex korshinskyi</i> <i>Chenopodium glaucum</i> <i>Cleistogenes squarrosa</i> <i>Kochia prostrata</i> <i>leymus chinensis</i> <i>Stipa grandis</i>
Peace et al. 1982	52.33°N, 0.2°E	<i>Impatiens parviflora</i>
Pratt 1984	42.8°N, -76°E	<i>Solidago graminifolia</i> <i>Solidago juncea</i>
Rogers et al. 2003	29.76°N, 95.38°E	<i>Sapium sebiferum</i> <i>Schizachyrium scoparium</i>
Saarinen T 1998	60.15°N, 25.03°E	<i>Carex rostrata</i>
Sardans et al. 2006	41.61°N, 1.83°E	<i>Erica multiflora</i>
Shaver et al. 2001	68.63°N, -149.58°E	<i>Betula nana</i> <i>Carex bigelowii</i> <i>Eriophorum vaginatum</i> <i>Ledum palustre</i> <i>Rubus chamaemorus</i> <i>Salix pulchra</i> <i>Vaccinium vitis-idaea</i>
Shevtsova et al. 2005	65.5°N, 19°E	<i>Empetrum hermaphroditum</i>
Silletti et al. 2004	39.01°N, -96.6°E	<i>Andropogon gerardii Vieman</i> <i>Sorghastrum nutans</i>
Skogen et al. 2011	41.8°N, -72.25°E	<i>Desmodium cuspidatum</i>

Song et al. 2010	31.7°N, 103.87°E	<i>Solidago canadensis</i>
Strengbom et al. 2004	64.23°N, 19.78°E	<i>Bauhinia faberi</i>
		<i>Deschampsia flexuosa</i>
		<i>Vaccinium myrtillus</i>
Strengbom et al. 2006	45°N, -93°E	<i>Solidago rigida</i>
Tilman 1984	45°N, -93°E	<i>Ambrosia artemisiifolia</i>
		<i>Aristida basiramea</i>
		<i>Chenopodium album</i>
		<i>Cyperus sp.</i>
		<i>Mollugo verticill</i>
		<i>Setaria glauca</i>
Tjoelker 1991	45°N, -93°E	<i>Liriodendron tulipifera</i> L.
		<i>Liriodendron tulipifera</i> L.
		<i>Pinus taeda</i>
Tu et al. 2013	29.7°N, 103.23°E	<i>Pleioblastus amarus</i>
Vallano et al. 2012	37.2°N, -121.67°E	<i>Cryptantha flaccida</i>
		<i>Lasthenia californica</i>
		<i>Layia gaillardiodes</i>
		<i>Lolium multiflorum</i>
		<i>Plantago erecta</i>
		<i>Vulpia microstachys</i>
Van et al. 2004	52.01°N, 5.6°E	<i>Carex panicea</i>
		<i>Holcus lanatus</i>
Vasileva et al. 2015	42.75°N, 25.5°E	<i>Medicago sativa</i>
Villar-Salvador et al. 2004	40.5°N, -3.2°E	<i>Quercus ilex</i>
Vinton et al. 1995	40.81°N, -107.78°E	<i>Agropyron smithii</i>
		<i>Aristida longiseta</i> Steud.
		<i>Artemisia frigida</i> Willd.
		<i>Bouteloua gracilis</i>
		<i>Stipa comata</i>
Voisin et al. 2002	47.3°N, 5°E	<i>Pisum sativum</i>
Wang et al. 2001	45.58°N, -84.67°E	<i>Populus tremuloides</i>
Wang et al. 2015	40°N, 116.3°E	<i>Alternanthera philoxeroides</i>
		<i>Alternanthera sessilis</i> L.
Wang 2006	33°N, 107°E	<i>Fargesia qinlingensis</i>
Wardle 2016	65.9167°N, 17.7167°E	<i>Empetrum hermaphroditum</i>
		<i>Hylocomium splendens</i>
		<i>Pleurozium schreberi</i>
		<i>Vaccinium myrtillus</i>
		<i>Vaccinium vitis-idaea</i>
Weih & Karlsson 2001	68.35°N, 18.81°E	<i>Betula pubescens</i>
Whitehead et al. 1997	53.38°N, 1.49°E	<i>Calluna vulgaris</i>
		<i>Pteridium aquilinum</i>

Will et al. 2002	31.21°N, -82.35°E	<i>Pinus taeda</i>
Witkowski et al. 1989	-33.9°N, 18.4°E	<i>Protea repens</i>
Witwicki et al. 2013	40°N, -115°E	<i>Artemisia tridentata</i> <i>Bromus tectorum</i> L.
Xiao et al. 2015	30.58°N, 103.63°E	<i>Pleioblastus amarus</i>
Xu et al. 2015	36.43°N, 117.45°E	<i>Quercus mongolica</i> <i>Quercus variabilis</i>
Yao et al. 2009	31.68°N, 103.88°E	<i>Acer mono Maxim</i>
Yuan et al. 2013	36.43°N, 117.45°E	<i>Quercus acutissima</i> <i>Rhus typhina</i> L.
Zamin et al. 2014	62.87°N, 111.55°E	<i>Betula glandulosa</i> <i>Bryocaulon divergens</i> <i>Cetraria cucullata</i> <i>Eriophorum vaginatum</i> <i>Rubus chamaemorus</i> <i>Vaccinium uliginosum</i> <i>Cetraria cucullata</i> <i>Cetraria laevigata</i> <i>Cetraria nivalis</i> <i>Cladina mitis</i> <i>Cladina rangiferina</i> <i>Cladonia gracilis</i> <i>Masonhalea richardsonni</i>
Zhang 2013	32.23°N, 118.6°E	<i>Phragmites australis</i> <i>Spartina alterniflora</i>
Zhao et al. 2009	31.68°N, 103.88°E	<i>Picea asperata</i> <i>Pinus tabulaeformis</i>
Zhou et al. 2011	44.5°N, 87.75°E	<i>Bassia hyssopifolia</i> <i>Malcolmia africana</i>
Zhu et al. 2013	23.17°N, 113°E	<i>Pinus massoniana</i>

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**Supporting information Table S2** The information of the 12 species from 7 independent N fertilization studies which simultaneously addition of  $\text{NH}_4^+\text{-N}$  and  $\text{NO}_3^-\text{-N}$ .

<b>Study</b>	<b>Site location</b>	<b>species name</b>
Arnamwong et al. 2015	32°N, 118.77°E	<i>Sedum plumbizincicola</i>
Burslem 1994	1.2°N, 103.5°E	<i>Dillenia suffruticosa</i>
He et al. 2016	38.9°N, 117.13°E	<i>Amaranthus retroflexus</i>
		<i>Eclipta prostrata</i>
		<i>Flaveria bidentis</i>
Kou 2015	26.7°N, 115°E	<i>Pinus elliottii</i>
Nordin et al. 2006	64.1°N, 19.46°E	<i>Vaccinium myrtillus</i>
		<i>Vaccinium vitis-idaea</i>
Shevtsova et al. 2005	65.5°N, 19°E	<i>Empetrum hermaphroditum</i>
Stevens 2014	54.0°N, -2.78°E	<i>Anthoxanthum odoratum</i>
		<i>Plantago lanceolata</i>
		<i>Prunella vulgaris</i>

**Supporting information Figure S1** Comparison the mean effects of  $\text{NH}_4^+\text{-N}$  and  $\text{NO}_3^-\text{-N}$  on 12 species plant biomass (a), plant above- or below-ground biomass (AGB or BGB, b) depend on plant categories. Values are means  $\pm$  SE. The symbol ns, \*, \*\* indicates the significance of the difference between  $\text{NH}_4^+\text{-N}$  and  $\text{NO}_3^-\text{-N}$  effect at the level of  $P > 0.1$ ,  $P < 0.05$ ,  $P < 0.01$ , respectively.

