Appendix S1. (Extended version of Table 1)
Unintended, *post hoc* functions of herbarium specimens with publications validating these uses, when available.

Specimen use	Description of potential applications	Citations
Genetics *– archival DNA to quantify genetic differences among species, populations, and individuals*		
Interspecific variation*	taxonomic identification (DNA barcoding)	(Buerki and Baker, 2015; Xu et al., 2015)
	Molecular systematics, evolution and phylogenetics	(Ranker and Worth, 1986; Windham & Hoffler, 1986; Bruns et al., 1990; Whitten et al., 1999; Zomlefer et al., 2006; Grusz et al., 2009; Staats et al., 2011; Särkinen et al., 2012; Tripp and Fatimah, 2012; Buerki and Baker, 2015; Weiß et al., 2015; Yeates et al., 2016)
Genotypic variation	'gene bank' for measuring variation within and among population across species' ranges and through time	(Rogers and Bendich, 1985; Whitten et al., 1999; Ristaino et al., 2001; Saltonstall, 2002; Ames and Spooner, 2008; Lambertini et al., 2008; Lister et al., 2008; Chun et al., 2010; Staats et al., 2011; Särkinen et al., 2012; Delye et al., 2013; Vandepitte et al., 2014; Martin et al., 2014; Weiß et al., 2015; Krinitsina et al., 2015; Brunet et al., 2016; Saville et al., 2016; Yeates et al., 2016)
	archived propagules ('seed vault') for 'resurrection' studies	Allsopp, 1952; Johnson, 1985; Windham et al., 1986; Bowles et al., 1993; Nakahama et al., 2015
Functional trait ecophysiology *- intraspecific phenotypic shifts through time, space and across environmental gradients*		
Morpho-physiology	plant height	(McGraw, 2001; Law and Salick, 2005; Buswell et al., 2011; Leger, 2013; Rollins et al., 2013; Dalrymple et al., 2015; Flores-Moreno et al., 2015)
	leaf morphometrics (area, thickness, leaf mass per area, shape, dissection, toothiness)	(Parkhurst, 1978; Peñuelas and Matamala, 1990; Royer et al., 2010; Lambrinos, 2010; Bonal et al., 2011; Buswell et al., 2011; Dolan et al., 2011; Blonder et al., 2012; Guerin et al., 2012; Queenborough and Porras, 2014; Dalrymple et al., 2015; Flores-Moreno et al.,

		2015; Tomaszewski and Górzkowska, 2016; Beauvais et al., 2017)
	leaf anatomy (stomatal, trichome, and vein densities)	(Aalders and Hall, 1962; Parkhurst, 1978; Barrington et al., 1986; Woodward, 1987; Peñuelas and Matamala, 1990; Beerling and Chaloner, 1993; Beerling and Woodward, 1993; Goertzen and Small, 1993; Paoletti and Gellini, 1993; Chen et al., 2001; Teece et al., 2002; Kouwenberg et al., 2003; Wagner et al., 2005; Miller-Rushing et al., 2009; Steets et al., 2010; Wagner-Cremer et al., 2010; Walls, 2011; Bonal et al., 2011; Tripp and Fatimah, 2012; Blonder et al., 2014)
	belowground anatomy and morphology	none?
Tissue chemistry	nutrient chemistry (leaf N, C, P)	(Peñuelas and Matamala, 1990, 1993; Peñuelas and Azcón-Bieto, 1992; Beerling and Woodward, 1993; Baddeley et al., 1994; Peñuelas and Estiarte, 1997; Peñuelas and Filella, 2001; Pedicino and Leavitt, 2002; Ryan et al., 2009; Wilson et al., 2009; McLauchlan et al., 2010; Mithen et al., 2010; Bonal et al., 2011; Delgado et al., 2013; Agnan et al., 2015; Korner et al., 2016; Rudin et al., 2017)
	stable isotopes ($\Delta^{13}C$, $\delta^{13}C$, $\delta^{15}N$, $\delta^{18}O$)	(Peñuelas and Azcón-Bieto, 1992; Peñuelas and Estiarte, 1997; Peñuelas and Filella, 2001; Teece et al., 2002; Helliker and Griffiths, 2007; Miller-Rushing et al., 2009; Wilson et al., 2009; Tripp and Fatimah, 2012; Delgado et al., 2013; Korner et al., 2016)
	Deuterium isotopomer ratios (carbon metabolism proxy)	(Ehlers et al., 2015)
	bioaccumulation or other effects of natural chemicals or anthropogenic pollutants (heavy metals, N deposition, particulates, smog, ozone)	(Herpin et al., 1997; Peñuelas and Filella, 2001; Kouwenberg et al., 2003; Ryan et al., 2009; Rudin et al., 2017)
	protein, fatty acid, and amino acid composition	(Teece et al., 2002)
	secondary metabolites in roots, leaves, or seeds	(Berenbaum and Zan, 1998; Zangerl and Berenbaum, 2005; Mithen et al., 2010)

Reproductive biology	flower or fruit number, morphology, size, anatomy	(Barrington et al., 1986; Carpenter et al., 2003; Knaus, 2010; Bontrager and Angert, 2016; Yu et al., 2016)
	pollen transport networks	A.L. Johnson, unpublished
Phenology	Flowering time (and other phenophases)	(McConnell and Russell, 1959; Carpenter et al., 2003; Primack et al., 2004; Bolmgren and Lonnberg, 2005; Lavoie and Lachance, 2006; Miller-Rushing et al., 2006; Houle, 2007; Gallagher et al., 2009; Neil et al., 2010; von Holle et al., 2010; Robbirt et al., 2011; Zalamea et al., 2011; Panchen et al., 2012; Diskin et al., 2012; Li et al., 2013; Calinger et al., 2013; Diez et al., 2013; Hart et al., 2014; Barve et al., 2015; Bertin, 2015; Munson and Sher, 2015; Park and Schwartz, 2015; Rawal et al., 2015; Davis et al., 2015; Matthews and Mazer, 2016; Park, 2016; Spellman and Mulder, 2016; Yu et al., 2016; Mulder et al., 2017; Munson and Long, 2017; Willis et al., in press)
	leaf-out time	(Everill et al., 2014; Zohner and Renner, 2014)
Herbivory	insect damage	(Goertzen and Small, 1993; Zangerl and Berenbaum, 2005; Youngsteadt et al., 2015; Schilthuizen et al., 2016)
	effects of overabundant large herbivores	(Beauvais et al., 2017)
Phytopathology	disease presence and damage	(Ristaino, 1998; Koponen et al., 2000; Ristaino et al., 2001; Antonovics et al., 2003; Li et al., 2007; Malmstrom et al., 2007; Hood et al., 2010; Brunet et al., 2016; Saville et al., 2016)
Symbiosis	taxonomic or genotypic diversity of mycorrhizal fungi or bacterial symbionts in rhizosphere and roots	none?
	endophyte presence and taxonomy	(White et al., 1992)
Non-target specimen research – *utilization of specimens preserved unintentionally with target collection originally of interest*		

Soil science	soil preserved with specimen roots as source of edaphic or belowground microbial information through space and time	none?
Invertebrate zoology	insects or other organisms pressed with leaves for understanding plant-insect interactions, insect taxonomy, and invasion ecology	(Lees et al., 2011; Veenstra, 2012)

**There are likely many more citations that use herbarium specimens as a source of DNA material, but do not explicitly highlight this method in abstract, title, or keywords.*

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