**METHODS**

***CWR and WUS Inventory***

We developed a current national inventory of CWR and WUS of Canada by combining relevant plant taxa from two sources. We first downloaded a list of native CWR and WUS from the GRIN Global Database – Crop Relative Query (https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearchcwr) with the search term “Native distribution” set to “Country==Canada”.

The query yields 418 entries, however, query output entries do not represent 418 unique CWR and WUS taxa. The query includes multiple entries per taxon, including an entry per associated crop (e.g *Vaccinium corymbosum* includes unique entries for it’s association with Bilberry and Highbush Blueberry) and an entry per known breeding trait (e.g *Vaccinium angustifolium* includes unique entries for breeding traits of “Crop Quality” and “Disease Resistance”). We reduced the output list to include one entry per unique CWR or WUS taxon, with a primary and secondary crop association (if applicable) rather than unique entries for each crop relationship. We also clustered associated crop categories for a selection of crops that share crop progenitors from the same taxonomic genus and also share a specific associated crop type. For example, apricot, cherry, peach, and plum are condensed to a single associated crop category while almond is retained as a separate crop category; although all of these crops share crop progenitors from the same taxonomic genus the associated crop type for the former are all classified as “Fruits” while the latter is classified with “Nuts”. All condensed associated crop groupings are included in Table 1, see further methods for associated crop type classifications.

When a CWR or WUS taxon was considered to have a different genepool for different associated crops that were grouped together, the closest genepool categorization was held for analysis. For example, *Castanea dentata* is a secondary relative to Chinese Chestnut and a primary relative to American Chestnut – two associated crops that were clustered as one crop group, “Chestnut”. In this case, *Castanea dentata* is listed as a primary relative for the crop group, “Chestnut”.

This reduced list included both taxa at the finest taxonomic resolution available as well as the species level when subspecies or varietal levels for a CWR or WUS exist. For example, the CWR, , is represented by three CWR Taxa entries:).

The Taxa included in the GRIN Global Database include primarily CWR of direct agricultural relevance. To increase the inclusion of culturally important medicinal and ornamental taxa and WUS food plants, as well as taxa that may be of use for forage and feed, and additionally taxa that are valued as native forest genetic resources, we integrated plant taxa considered in previous descriptions of plants of economic importance in Canada (Davidson 1995) as well as a treatment of food plants used by indigenous peoples (Kuhnlein and Turner 2020). We targeted the addition of new taxa, excluding non-native taxa. These taxa were grouped with corresponding crop relationship categories from the GRIN taxon list when applicable, or otherwise were assigned crop relationship categories defined at the genus level.

Associated crops were grouped at general and specific levels. General levels include: “Foods”, “Cultural”, and “Forest Resources”. At the specific level, “Foods” were divided into categories of: “Fruits”, “Nuts”, “Vegetables”, “….

Taxa allowed to assign to multiple specific uses.

TABLE 1: GROUPED ASSOCIATED CROPS: Crops that were aggregated into broader units

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| **Associated crops that were grouped together** | **New name for associated crop** |
| Apricot, Sweet-Cherry, Cherry, Peach, European-Plum, Japanese-Plum, Myrobalan-Plum, Ornamental-Cherry | Apricot, Cherry, Peach, Plum |
| Bilberry, Low-bush Blueberry, High-bush blueberry, Rabbit’s eye Blueberry | Blueberry |
| Blackberry, Black-Raspberry, Red-Raspberry | Blackberry, Raspberry |
| Leek, Japanese Bunching/Welsh, Onion | Allium |
| Purple-Amaranth, Inca-Wheat, Prince’s-Feather | Amaranth |
| American Chestnut, Chinese Chestnut, Japanese Chestnut | Chestnut |
| European Filbert, Turkish Filbert | Filbert |
| Black Walnut, English Walnut, Butternut, Japanese Walnut | Walnut |
| Lupine, Andean-Lupine | Lupine |
| Corn-Mint, Japanese Corn-mint, Spear-mint | Mint |
| Red-Currant, Black-Currant, Gooseberry | Currant, Gooseberry |
| Rice, Wild-Rice | Rice, Wild-rice |
| Pecan, Hickory | Pecan, Hickory |

Taxon names were validated using the GRIN Taxonomy Plant Search in GBIF (<https://www.gbif.org/species/160086293>). Any taxon names that were not found in GRIN Taxonomy Plant Search were also checked using the Canadensys - Database of Vascular Plants of Canada (VASCAN, <https://data.canadensys.net/vascan/search?lang=en>). Taxon names that were not recovered in either database were removed from the inventory.

Taxa sourced from Davidson 1995 and Kuhnlein and Turner 2020 were only resolved to the species level. All of these taxa were expanded to include all subspecies and varietals that occur in Canada, again using the GRIN Taxonomy Plant Search or the Canadensys – VASCAN tools.

Using the Canadensys – VASCAN tool, Taxa were scored as “Native” or “Introduced”. Taxa were considered Native so long as they were native to at least one province, even if they are considered introduced in other provinces. For example, *Blitum nuttallianum* is native to several provinces including Saskatchewan and Manitoba, but introduced in Quebec and British Columbia. Nonetheless this taxon is still scored as Native in the inventory.

Taxa were given a binary score for CWR status, with positive score if they were in the genepool of any Crops listed in the GRIN-Global Crop Wild Relative Criteria. By this definition, all taxa from the GRIN database source were scored as CWR. Additional taxa in the inventory from the Kuhnlein and Turner 2020 and Davidson 1995 sources when associated with a crop genepool in the GRIN-Global Crop list: e.g. *Physalis heterophylla* and *Physalis virginiana* gathered from Kuhnlein and Turner 2020’s treatment of indigenous food plants could be assigned to the Tertiary genepool of the GRIN-Global crop, Tomatillo, and thus were also scored as CWR.

We added several Crops – whose close relatives are scored as CWR in the inventory – based on national interests and definitions of Crops that extend beyond direct use for human consumption. Given potential special national importance in Canada, we added the following crops: Sugar Maple (Food – Sugars), Saskatoon-berry (Food – Fruits), and Physaria (Food – Oils). We also included relatives of the following forage and feed crop groups under our definition of CWR: Bentgrass, Bluegrass, Bluejoint, Bluestem, Brome Grass, Canary Grass, Clover, Lathyrus, Milk-vetch, Sainfoil, Timothy, Trefoil and Vetch.

Plant taxa with primary use as Ornamentals, which are important economic plants to consider for x, y, z, are included in the inventory but were not scored as CWR. **ALTERNATIVELY:** We ***COULD ADD*** the following Crops of high ornamental value – whose close relatives are scored as CWR in the inventory: Barberry, Blanket-flower, Bleeding-heart, Camas, Cornus, Elderberry, Elm, Fawn-lily, Fir, Hackberry, Highbush-cranberry (Viburnum), Linden, Magnolia, Monarda, Oak, Pine, Rose, Spiderwort, and Water-lily.

Forest resources, which are important to consider beyond use as food or ornamentals for x, y , z reasons (Davidson 1995) are included in the inventory but were not scored as CWR.

CWR were assigned to primary, secondary, or tertiary genepools, and potential use as graftstock recorded. CWR were assigned to two tiers: tier 2 for CWR with primary use of forage and feed OR medicinals, and tier 1 for all other CWR. Prioritization category for CWR was then assigned by combining the genepool score with the tier for each CWR, with genepools corresponding to primary=A, secondary=B, and tertiary=C. In the case that a CWR is in the secondary or tertiary genepools, but graftstock use is known, the prioritization category was upgraded to 1A. Because tier 2 CWR do not typically correspond to a single target crop, tier 2 CWR were all scored with a same prioritization level of 2.

We also scored all taxa as WUS based on their inclusion in indigenous food systems (Kuhnlein and Turner 2020) or wild utilization for other purposes (list here). Some taxa in the inventory are exclusively CWR or exclusively WUS, however, many of the taxa overlap as both CWR and WUS. We did not devise a conservation prioritization scheme for WUS.

**DETERMINE GEOGRAPHIC RANGE of CWR and WUS**

“To determine the geographic range of each taxon (a proxy for the range of potential genetic diversity of each taxon) we downloaded validated occurrence data from the Global Biodiversity Information Facility ('GBIF' - <https://www.gbif.org/>, 2021). We requested occurrence data via R using the ‘rgbif’ package (cite), filtering occurrence data to include observations from the following categories: ‘preserved specimen’, ‘human observation’, ‘observation’, and ‘machine observation’. Many Canadian CWR and WUS occur more broadly across North America (Khoury et al. 2020). The ex situ conservation status of these broadly occurring taxa in United States repositories has been recently assessed (Khoury et al. 2020). Therefore, we focused on defining the range of each CWR and WUS within Canada and subsequently assessing the conservation of CWR and WUS across the Canadian portion of the range in Canadian conservation systems. To limit the defined ranges of CWR and WUS to the national scale, we specified occurrences matching ‘country’ == ‘Canada’ in our GBIF data request.

Using the output GBIF occurrence data, we created two sets of binary (presence/absence), within-Canada species distribution maps. Ecoregion defined species distribution maps were generated by conducting a spatial join between the occurrence data and the Nature Conservancy’s Level III (?) Terrestrial Ecoregion map (The Nature Conservancy, 2020), using the \_ package in R. Ecoregions represent geographic areas delineated by climate, geology, physiography and for their characteristic biodiversity patterns (The Nature Conservancy, 2020). Defining CWR and WUS distributions at the Ecoregion scale provides valuable information of potential genetic diversity, because these geographic units define unique abiotic and biotic pressures to CWR and WUS populations. Furthermore, Ecoregions are often used by conservation non-profit organizations and non-profit organizations as the spatial unit for ecological assessment and conservation action planning (The Nature Conservancy, 2020). Therefore, defining CWR and WUS occurrence in Ecoregions will be valuable for future in situ conservation planning.

Administrative, provincial species distribution maps were created by conducting a spatial join between the occurrence data and a provincial boundary layer (Statistics Canada, 2011) using \_ () in R. Because abiotic and biotic pressures to natural populations are not fully circumscribed by administrative boundaries (), defining CWR and WUS distributions in provincial boundaries versus Ecoregion units provides a coarser assessment of potential genetic diversity. However, this second set of distribution maps still provides valuable information, as federal and provincial in situ conservation planning often relies on provincial administrative structures (). Furthermore, occurrence data as well as collection accession provenance data (the geographic location where an accession was acquired) is often only available at the provincial scale. Thus, constructing provincial species distribution maps provides an opportunity to expand and assessment of the current conservation status of CWR and WUS in Canadian ex situ conservation systems.

Finally, we manually trimmed the species distribution maps to reduce overestimation of CWR and WUS geographic ranges. We removed provinces from an occurrence range if the province was considered neither “native” or “introduced but established” according to a Flora reference - Flora of North America eFlora (FNA 2021) as a reference, using The Database of Vascular Plants of Canada (VASCAN) and/or the University of Texas Native Plants of North America Database (UT NPNA). We removed ecoregions from an occurrence range if the ecoregion was completely bounded within a removed province. This effort was intended to remove occurrence points in the GBIF dataset that represent plants grown in controlled cultivation outside of their native range, for example *Castanea dentata* (chestnut) was removed from the province of British Columbia, where the species is not historically native nor are populations of introduced plants established, and occurrence points likely represent plants grown in a controlled cultivated context. We included regions where plants were introduced but established in our definition of a native region because these regions might reflect areas where CWR are adapting to unique environmental conditions. For example, *Vaccinium corymbosum* (blueberry) is introduced in British Columbia, but it is known to occur outside of cultivation in this region. Wild populations of *V. corymbosum* in British Columbia may be adapting to local conditions and this adaptation may be useful for future plant breeding purposes. All manual changes made to the native ranges of CWR are listed in Supplementary Table S7.”

**To Actually do this all:**

Graphical user interface, website, calendar

Description automatically generated