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Seeing the Forest Below the Trees: Occurrences of Shrubs in the Pacific Northwest

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Forest Service
Pacific Northwest Research Station
General Technical Report PNW-GTR-980
January 2020

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Cover: Pacific rhododendron (*Rhododendron macrophyllum*) growing in a canopy gap on the Olympic Pennisula. Photo by Leslie Brodie, USDA Forest Service.

Abstract

Strunk, Jacob L.; Harrington, Constance A., Brodie, Leslie C.; Prevéy, Janet S. 2020. Seeing the forest below the trees: occurrences of shrubs in the Pacific Northwest. Gen. Tech. Rep. PNW-GTR-980. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 87 p.

Shrubs are an important component of terrestrial plant communities in both forested and nonforested ecosystems, but relatively little information is available on their distributions. This project provides mapped occurrences for 78 native shrub species found in the Pacific Northwest (Oregon, Washington, Idaho, and western Montana) as derived from two large regional databases: the U.S. Department of Agriculture, Forest Service Forest Inventory and Analysis database of vegetation collected as part of a nationwide forest inventory and the Consortium of Pacific Northwest Herbaria online database (http://www.pnwherbaria.org) of species locations from forested and nonforested habitats. Background information on the project and maps of locations by species and data source are included.

Keywords: Shrubs, location, map, Pacific Northwest, western Montana, Idaho, Oregon, Washington.

Contents

Introduction

Shrubs are an important component of terrestrial plant communities in both forested and nonforested ecosystems. They may be the dominant species in nonforested landscapes or an integrated member of very diverse plant communities (Francis 2004). Generally defined as perennial plants with woody stems (usually multiple stems), shrubs vary in stature from tree-like shrubs up to 10 m tall to subshrubs or viney shrubs with a maximum height of less than 0.5 m (Pojar and MacKinnon 1994). Shrubs provide structure for nesting and foraging habitat for many animals (Martin et al. 1961) and substrate for insect and disease organisms as well as lichens and bryophytes (Tappeiner et al. 2015). In addition, because their short stature increases foraging opportunities for people and nonflying animals and because many shrubs have fleshy berries or nuts, shrubs contribute to food resources far beyond what might be expected based on their biomass in the ecosystem. For example, more than 50 percent of the shrubs in the Pacific Northwest coast area of Oregon, Washington, British Columbia, and Alaska have fleshy fruits, often, in the form of edible berries (Pojar and MacKinnon 1994). Furthermore, several species of shrubs are traditionally used by American Indian tribal members as a food resource and for teas, dyes, medicines, implements, and other cultural purposes (Gunther 1945; Turner 1995, 1997; Turner et al. 1990).

Despite the importance of shrubs, detailed range maps are not available for many northwest shrub species. Most plant identification books (e.g., Hitchcock and Cronquist 1973, Pojar and McKinnon 1994) or plant association guides (e.g., Brockway et al. 1983, Hemstrom et al. 1982) describe the types of habitats in which a species is found, e.g., "marshy lowland habitats," or indicate a very general geographic range such as "west of the Cascade Crest from British Columbia to central Oregon." Elbert Little published a series of atlases for many U.S. tree species, including one on "minor western hardwoods" (Little 1976) with general range maps for several of the larger shrubs such as vine maple, serviceberry, hazelnut, and cherry; however, it did not include smaller plants such as those in the *Rubus* or *Vaccinium* genera. The online USDA PLANTS database (USDA NRCS 2006) includes range maps for many species, but their finest level of resolution indicates only whether a species is present within a county. Our preliminary evaluation of several northwest shrubs revealed that some counties with multiple occurrences of a species, as determined from other sources, are not shown by the PLANTS database to be part of the range of that species. Conversely, some very large counties are displayed as part of the species range when the plant may be found only in a small portion of the county. Thus, we concluded that better species occurrence maps were needed of shrubs in this region.

Datasets

We were interested in determining where shrub species are currently found in Washington, Oregon, Idaho, and western Montana as the first step in developing habitat suitability or range models that can be used to predict where a species might grow now and, as climates alter, in the future. For example, current range breadth could be an indicator of sensitivity to changing climate or habitat specificity (Emery et al. 2018). We used publicly available data sources to document current plant occurrences of common and culturally important shrub species across the Pacific Northwest region. To select which species to evaluate, we first started with the plot data collected by the U.S. Department of Agriculture, Forest Service Forest Inventory and Analysis (FIA) program, which inventories resources on forested lands in the United States, as this grid of plots would cover the entire geographic area we were interested in studying. The FIA database (https://apps.fs.usda.gov/fia/datamart/CSV/datamart_csv.html) indicated that potentially hundreds of shrub species (species recorded by field personnel as having a structure of tree-shrub, shrub, subshrub, dwarf shrub, or viney shrub with cover of greater than 3 percent) were present in the Pacific Northwest area. We decided to focus on native shrub species that were present in 75 or more unique FIA plot locations. This resulted in 78 species for our geographic area. Note that FIA primarily inventories forested lands (see additional discussion below), so our 78 species were either forest-associated species, found in woodlands or ecotones, or were in a few plots found in nonforested areas on national forests. This inventory source does not generally cover shrub-steppe or other open areas. Downloaded data included plots measured in 2016 or earlier.

Our second information source was the Consortium of Pacific Northwest Herbaria, an association of 60 regional herbaria with an online database (CPNH 2017). We downloaded the records for the 78 shrub species selected from the FIA database (USDA FS 2015). The consortium database includes data from multiple herbaria sources across the Pacific Northwest, with individual herbarium specimens collected in different locations for diverse purposes over a period of more than 200 years, in some cases (although most specimens were collected after 1920). These data were not restricted to forested locations.

We are aware of other datasets that include locations of specific shrubs (e.g., Oregon Flora, Forest Service and U.S. Department of the Interior Bureau of Land Management ecology plots, National Phenology Network, and iNaturalist). We chose not to include them as part of this project because of geographic constraints for some datasets or lack of documentation. However, these datasets may be very useful for other types of projects that document plant locations and in the

Table 1—Datasets used to map occurrences for 78 native shrub species found in the Pacific Northwest (Oregon, Washington, Idaho, and western Montana)

Attribute	Pacific Northwest FIA vegetation plots	Consortium of Pacific Northwest Herbaria
Type of sampling	Grid	Varies based on individual project, some projects follow roads or trails
Years of data	Started in 2003	Some samples are from the 1800s
Detection of uncommon species	Not recorded if <3 percent cover	Can record if only one plant found
Type of observer and plant knowledge	Trained crew but not experts in plant identification (vouchers not collected)	From novice to expert (vouchered specimens available for all plants in this database)
Plant communities sampled	Primarily forested areas	Can sample all vegetation types
Location accuracy	"Fuzzed" slightly to protect landowner privacy concerns[a]	Range from precise estimates to very general locations, especially for older observations

FIA = Forest Inventory and Analysis.
[a] Fuzzed locations are generally within 1.6 km and ± 30.5 m in elevation of the actual location (USDA FS 2015).

future are likely to grow dramatically both in geographic extent and number of observations. This may apply particularly to datasets associated with citizen science contributions.

The two datasets we used are very large databases that cover our area of interest. They differ in several important ways (see table 1), including the type of sampling and the type of habitats that were sampled. We see these data sources as complementary, but users need to be aware of the differences in the way the data were collected.

Assumptions and Limitations

Although the FIA observations are valuable for making inferences about species ranges on forest lands, the data are primarily limited to lands designated as "forest" (areas ≥0.4 ha with tree cover ≥10 percent, including recently disturbed forests without trees), large riparian strips, and some nonforested areas on national forests. In addition, the requirement that plant cover be ≥3 percent for the species to be recorded means that small plants would generally be underrepresented in the data. Thus, the FIA data cannot be interpreted as range maps. Herbaria data, in contrast, can be observed on forest or nonforest land, but the locations of herbaria

observations are purposive, or nonrandom. Absence of herbaria observations in an area may be due to species absence or to lack of sampling. Thus, neither data source can represent the full range or habitat breadth of a species, but both are informative with respect to areas in which the species were observed. It would be desirable if habitat suitability or fine-scale range models could be developed for many of these species in the future, but currently doing so is beyond the scope of this project. We hope these current maps will be useful in the near term until more detailed analyses can be completed.

We have included all observations regardless of the year that the data were collected (e.g., 1900 vs. 2000), although we recognize that environmental conditions at a particular site may no longer support a particular species as a result of, for example, erosion, urbanization, agriculture, forest management, or changes in climate.

Information Provided in This Project

These maps include data for 78 shrub species in our geographic area from the 2016 FIA database and from data contributed to the Consortium of Pacific Northwest Herbaria, as of June 1, 2018.

The maps are organized alphabetically by scientific name. If you wish to search for a common name, use the search feature (on a PC, hit Ctrl+F, then enter the common name). In the appendix is a table of scientific and common names with links to the USDA PLANTS database (USDA NRCS 2006) for additional information.

Notes on maps—

The maps include a forested layer to illustrate the areas in which FIA sampling could occur. The points from FIA plots were plotted with closed symbols that are partially transparent. Thus, if there were multiple points in a general area, the plotting symbols will appear to be darker in color than points in areas with few observations. The plotting symbols from the Consortium of Pacific Northwest Herbaria were plotted with open diamonds to minimize occluding the underlying FIA points. The plotting points were made large enough to reduce concerns about landowner privacy (each symbol covers approximately 160 ha; moreover, the locations from the FIA plots were slightly "fuzzed").

Acknowledgments

We downloaded plant location data by species from the database of the Consortium of Pacific Northwest Herbaria, an association of more than 60 regional herbaria; we thank the contributors to these datasets. Funding from the U.S. Geological Survey Northwest Climate Science Center partially supported this project.

U.S. Equivalents

When you know:	Multiply by:	To get:
Kilometer (km)	0.621	Miles
Meters (m)	3.28	Feet
Hectares (ha)	2.47	Acres

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Appendix

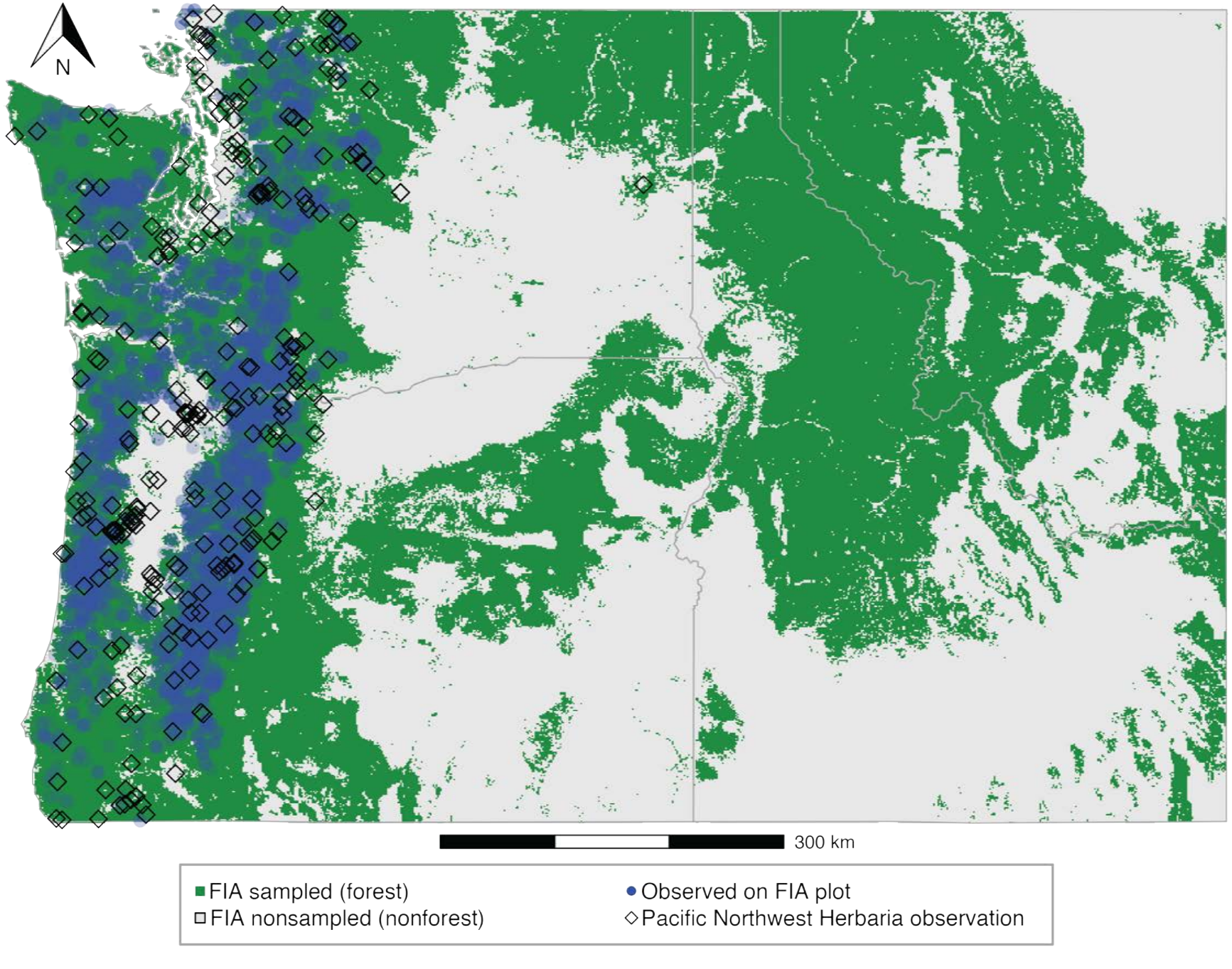
Common, scientific, and stanardized symbol names of Pacific Northwest shrubs are given here, as well as links to additional information in the USDA PLANTS online database (USDA NRCS 2016).

Scientific name	Common names	Symbol and link
Acer circinatum Pursh	vine maple	ACCI
Acer glabrum Torr.	Rocky Mountain maple, Douglas maple	ACGL
Alnus incana (L.) Moench	gray alder	ALIN2
Alnus viridis (Chaix) DC.	green alder	ALVI5
Amelanchier alnifolia (Nutt.) Nutt. ex M. Roem.	Saskatoon serviceberry	AMAL2
Arctostaphylos nevadensis A. Gray	pinemat manzanita	ARNE
Arctostaphylos patula Greene	greenleaf manzanita	ARPA6
Arctostaphylos uva-ursi (L.) Spreng.	kinnikinnick, common bearberry	ARUV
Artemisia arbuscula Nutt.	little sagebrush	ARAR8
Artemisia tridentata Nutt.	big sagebrush	ARTR2
Ceanothus prostratus Benth.	prostrate ceanothus	CEPR
Ceanothus sanguineus Pursh	redstem ceanothus	CESA
Ceanothus velutinus Douglas ex Hook.	snowbrush ceanothus	CEVE
Cercocarpus ledifolius Nutt.	curl-leaf mountain mahogany	CELE3
Chrysothamnus viscidiflorus (Hook.) Nutt.	yellow rabbitbrush	CHVI8
Cornus sericea L.	redosier dogwood	COSE16
Corylus cornuta Marshall	beaked hazelnut, California hazelnut	COCO6
Crataegus douglasii Lindl.	black hawthorn	CRDO2
Ericameria nauseosa (Pall. ex Pursh) G.L. Nesom & Baird	rubber rabbitbrush	ERNA10
Frangula purshiana (DC.) A. Gray	Cascara buckthorn	FRPU7
Gaultheria ovatifolia A. Gray	western teaberry	GAOV2
Gaultheria shallon Pursh	salal	GASH
Holodiscus discolor (Pursh) Maxim.	oceanspray	HODI
Juniperus communis L.	common juniper, ground juniper	JUCO6
Juniperus scopulorum Sarg.	Rocky Mountain juniper	JUSC2
Ledum glandulosum Nutt.	western Labrador tea	LEGL
Ledum groenlandicum Oeder	bog Labrador tea	LEGR
Linnaea borealis L.	twinflower	LIBO3
Lonicera utahensis S. Watson	Utah honeysuckle	LOUT2
Mahonia aquifolium (Pursh) Nutt.	hollyleaved barberry, tall Oregon grape	MAAQ2
Mahonia nervosa (Pursh) Nutt.	Cascade barberry, dull Oregon grape	MANE2
Mahonia repens (Lindl.) G. Don	creeping barberry, creeping Oregon-grape	MARE11
Malus fusca (Raf.) C.K. Schneid.	Oregon crab apple, Pacific crab apple	MAFU
Menziesia ferruginea Sm.	rusty menziesia, false azalea	MEFE
Oemleria cerasiformis (Torr. & A. Gray ex Hook. & Arn.) Landon	Indian plum	OECE
Oplopanax horridus (Sm.) Miq.	devilsclub	OPHO
Paxistima myrsinites (Pursh) Raf.	Oregon boxleaf, mountain boxwood	PAMY
Philadelphus lewisii Pursh	Lewis' mock orange, mock orange	PHLE4

Scientific name	Common names	Symbol and link
Phyllodoce empetriformis (Sm.) D. Don	pink mountainheath, pink mountain heather	PHEM
Physocarpus malvaceus (Greene) Kuntze	mallow ninebark, Pacific ninebark	PHMA5
Prunus emarginata (Douglas ex Hook.) D. Dietr.	bitter cherry	PREM
Prunus virginiana L.	chokecherry	PRVI
Purshia tridentata (Pursh) DC.	antelope bitterbrush	PUTR2
Quercus chrysolepis Liebm	canyon live oak	QUCH2
Rhododendron albiflorum Hook.	Cascade azalea, white-flowered rhododendron	RHAL2
Rhododendron macrophyllum D. Don ex G. Don	Pacific rhododendron	RHMA3
Ribes bracteosum Douglas ex Hook.	stink currant	RIBR
Ribes cereum Douglas	wax currant	RICE
Ribes lacustre (Pers.) Poir.	prickly currant, black gooseberry	RILA
Ribes montigenum McClatchie	gooseberry currant	RIMO2
Ribes viscosissimum Pursh	sticky currant	RIVI3
Rosa gymnocarpa Nutt.	dwarf rose, baldhip rose	ROGY
Rosa nutkana C. Presl	Nootka rose	RONU
Rosa woodsii Lindl.	Woods' rose	ROWO
Rubus lasiococcus A. Gray	roughfruit berry, dwarf bramble	RULA2
Rubus leucodermis Douglas ex Torr. & A. Gray	whitebark raspberry, blackcap	RULE
Rubus parviflorus Nutt.	thimbleberry	RUPA
Rubus pedatus Sm.	strawberryleaf raspberry	RUPE
Rubus spectabilis Pursh	salmonberry	RUSP
Rubus ursinus Cham. & Schltdl.	California blackberry, trailing blackberry	RUUR
Salix scouleriana Barratt ex Hook.	Scouler's willow	SASC
Sambucus nigra L.	black elderberry, black elder	SANI4
Sambucus racemosa L.	red elderberry, red elder	SARA2
Shepherdia canadensis (L.) Nutt.	russet buffaloberry, soapberry	SHCA
Sorbus scopulina Greene	Greene's mountain ash	SOSC2
Sorbus sitchensis M. Roem.	western mountain ash	SOSI2
Spiraea betulifolia Pall.	white spirea	SPBE2
Symphoricarpos albus (L.) S.F. Blake	common snowberry, waxberry	SYAL
Symphoricarpos hesperius G.N. Jones	trailing snowberry	SYHE
Symphoricarpos oreophilus A. Gray	mountain snowberry	SYOR2
Toxicodendron diversilobum (Torr. & A. Gray) Greene	Pacific poison oak	TODI
Umbellularia californica (Hook. & Arn.) Nutt.	California laurel	UMCA
Vaccinium cespitosum Michx.	dwarf bilberry, dwarf blueberry	VACE
Vaccinium membranaceum Douglas ex Torr.	thinleaf huckleberry, black huckleberry	VAME
Vaccinium myrtillus L.	whortleberry	VAMY2
Vaccinium ovalifolium Sm.	oval-leaf blueberry	VAOV
Vaccinium ovatum Pursh	California huckleberry, evergreen huckleberry	VAOV2
Vaccinium parvifolium Sm.	red huckleberry	VAPA
Vaccinium scoparium Leiberg ex Coville	grouse whortleberry, littleleaf huckleberry	VASC

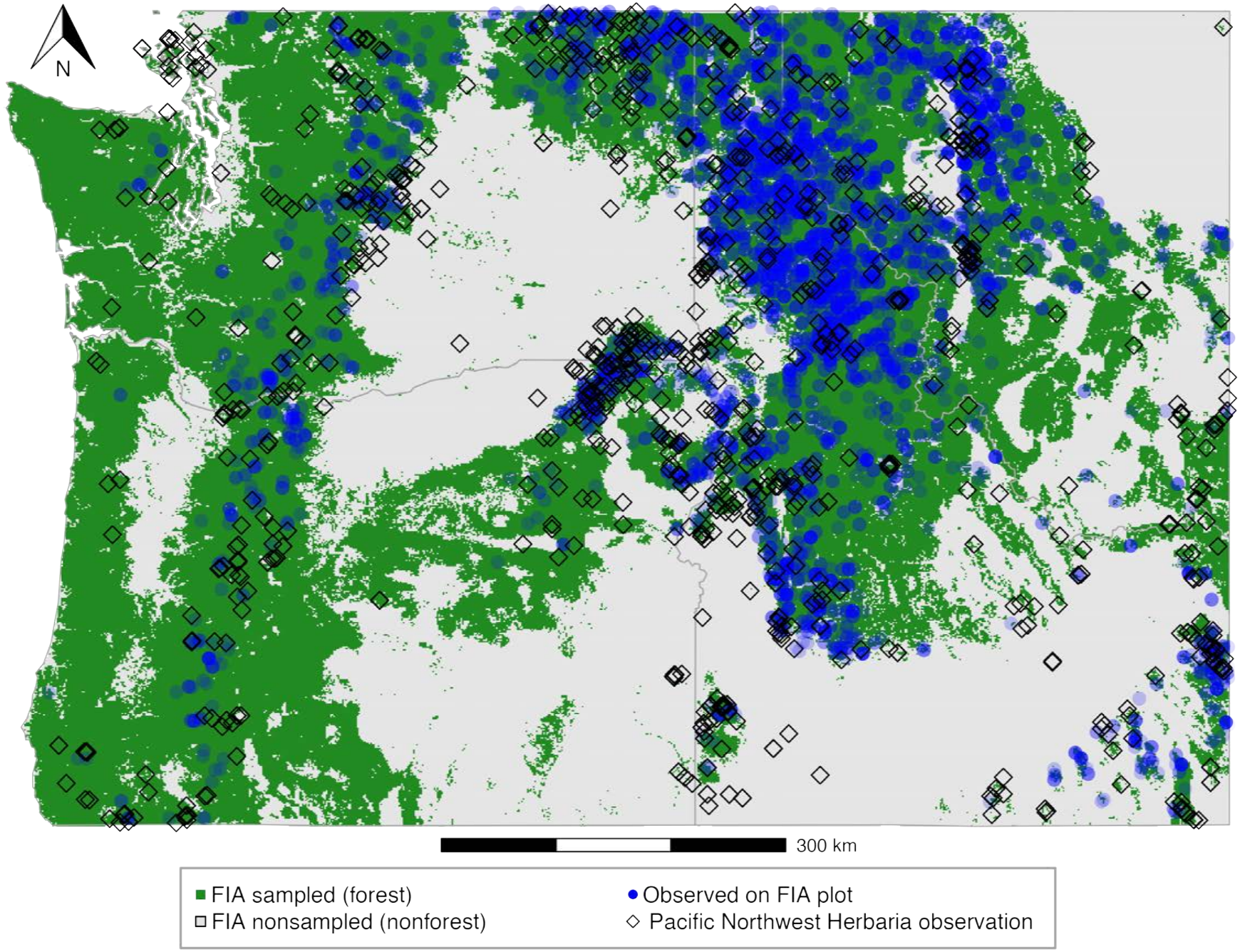
vine maple (n = 2002)

Acer circinatum



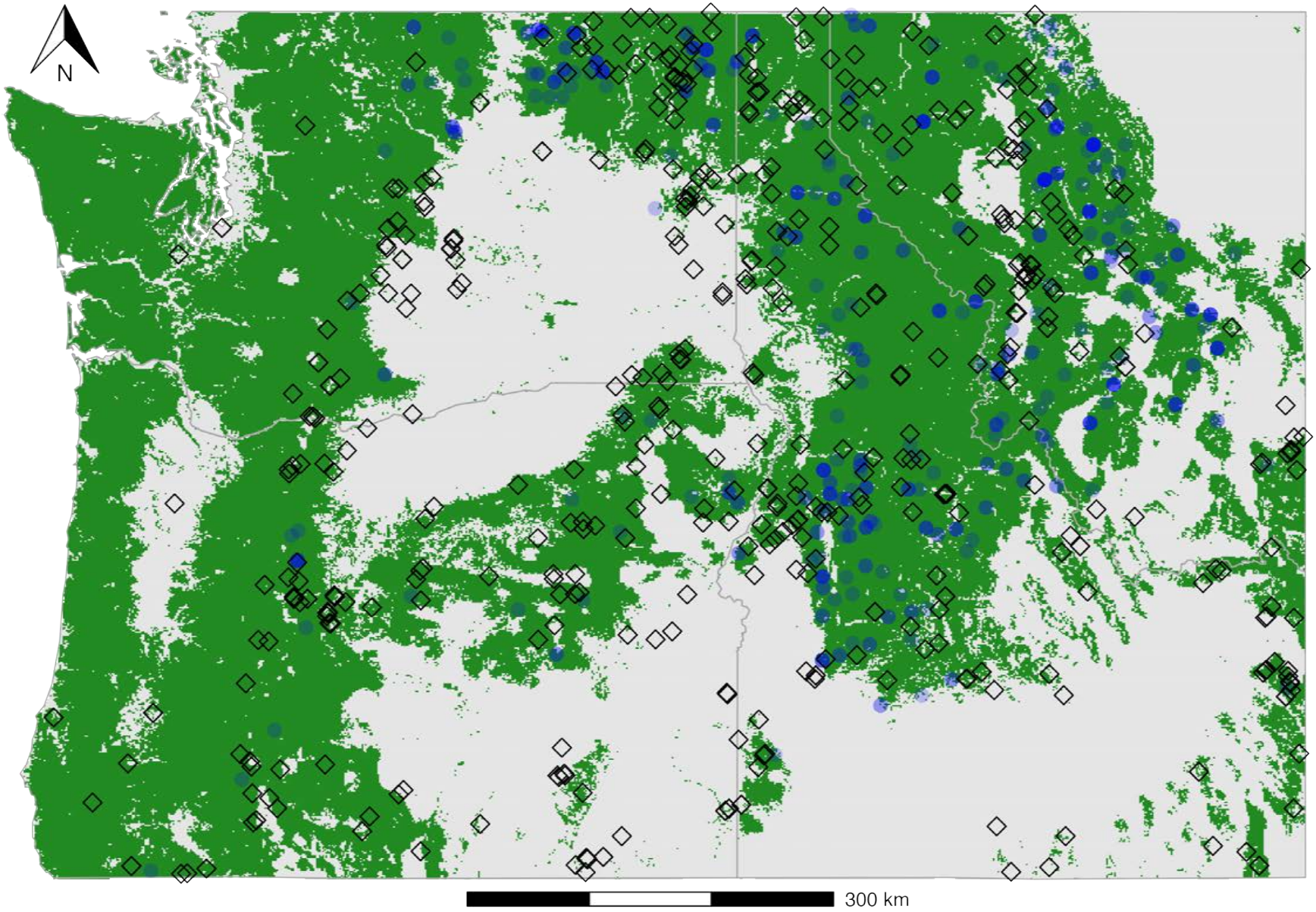
Rocky Mountain maple, Douglas maple (n = 2980)

Acer glabrum



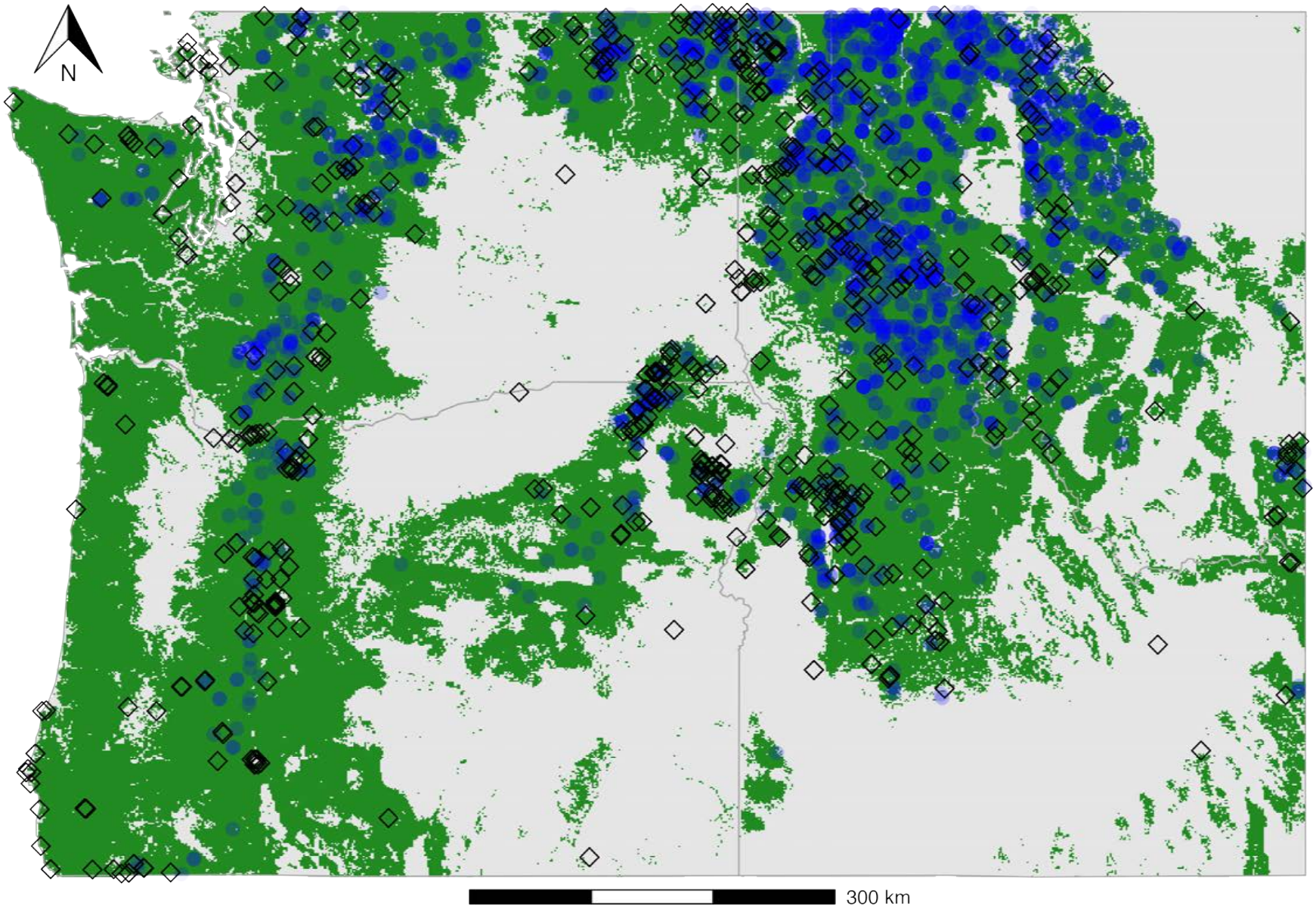
gray alder (n = 746)

Alnus incana



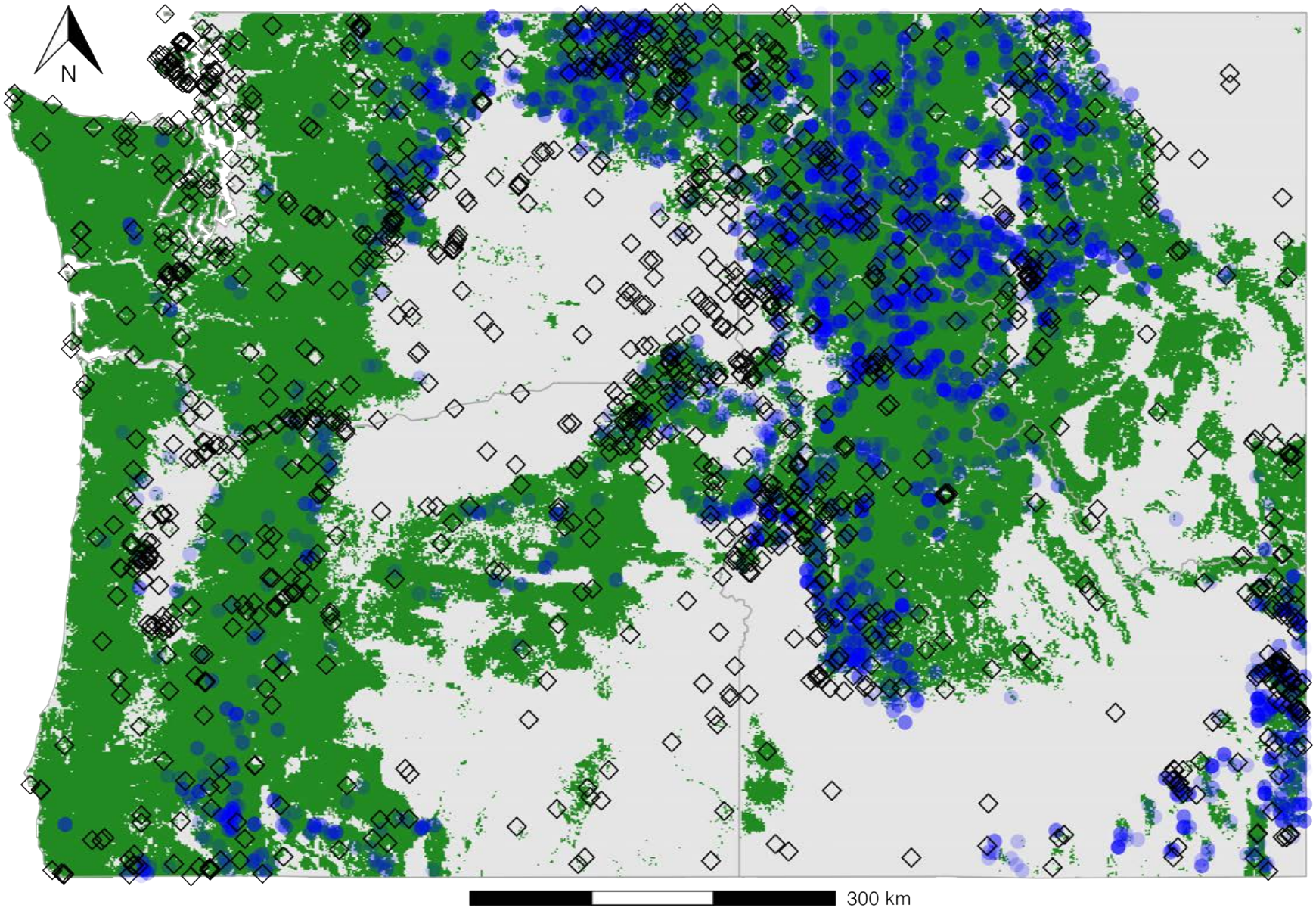
green alder (n = 1884)

Alnus viridis

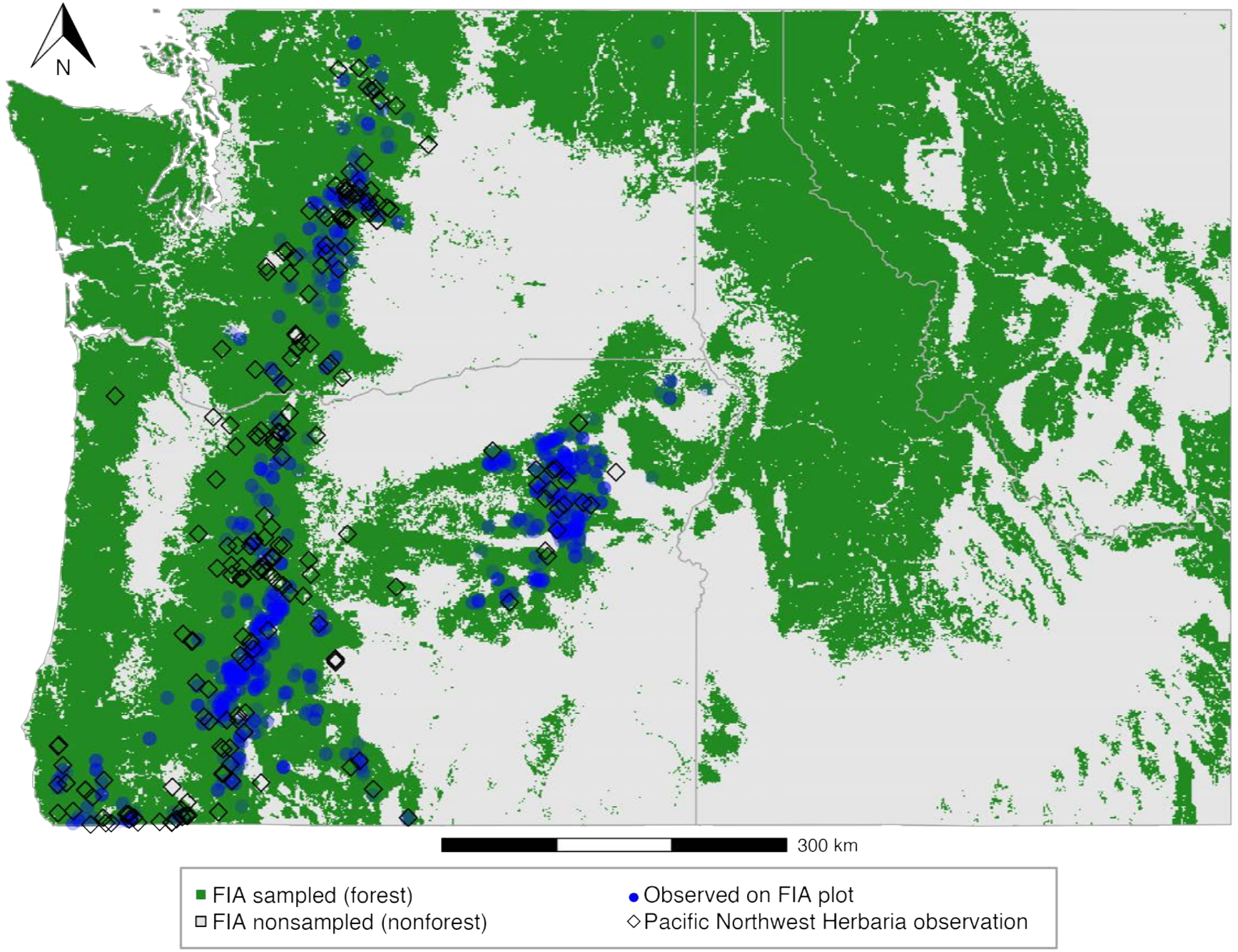


Saskatoon serviceberry (n = 3108)

Amelanchier alnifolia

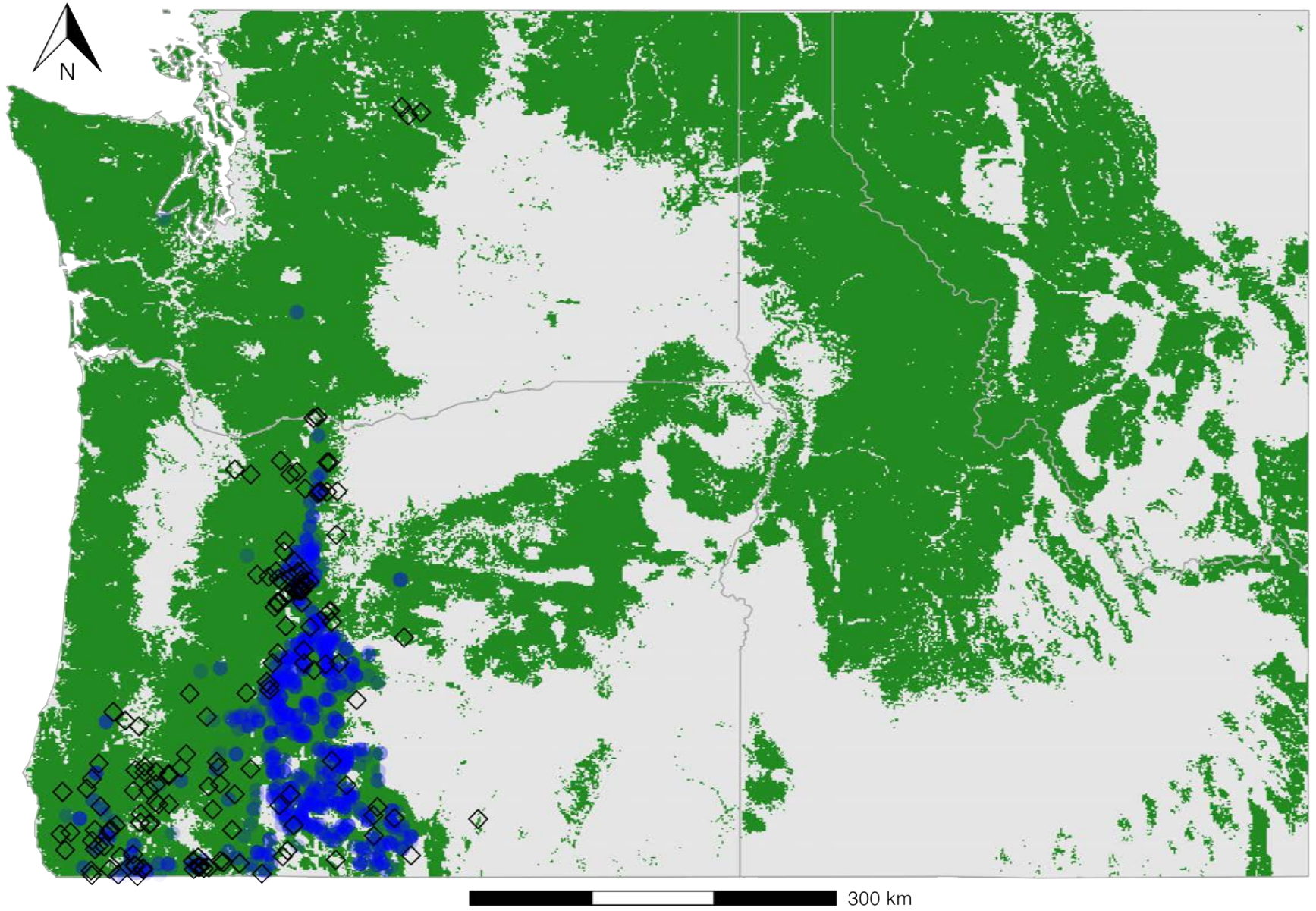


pinemat manzanita (n = 730)
Arctostaphylos nevadensis



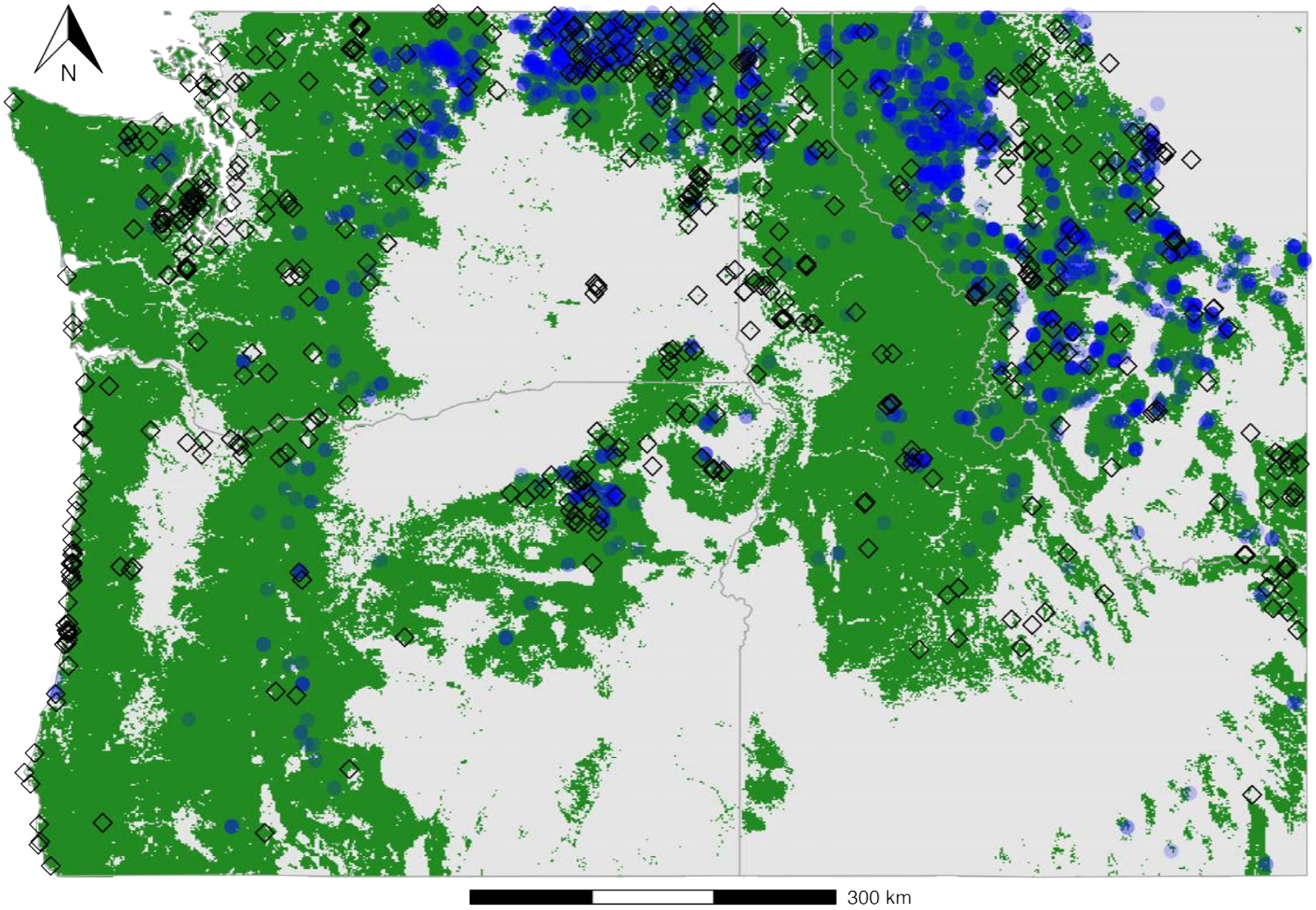
greenleaf manzanita (n = 624)

Arctostaphylos patula



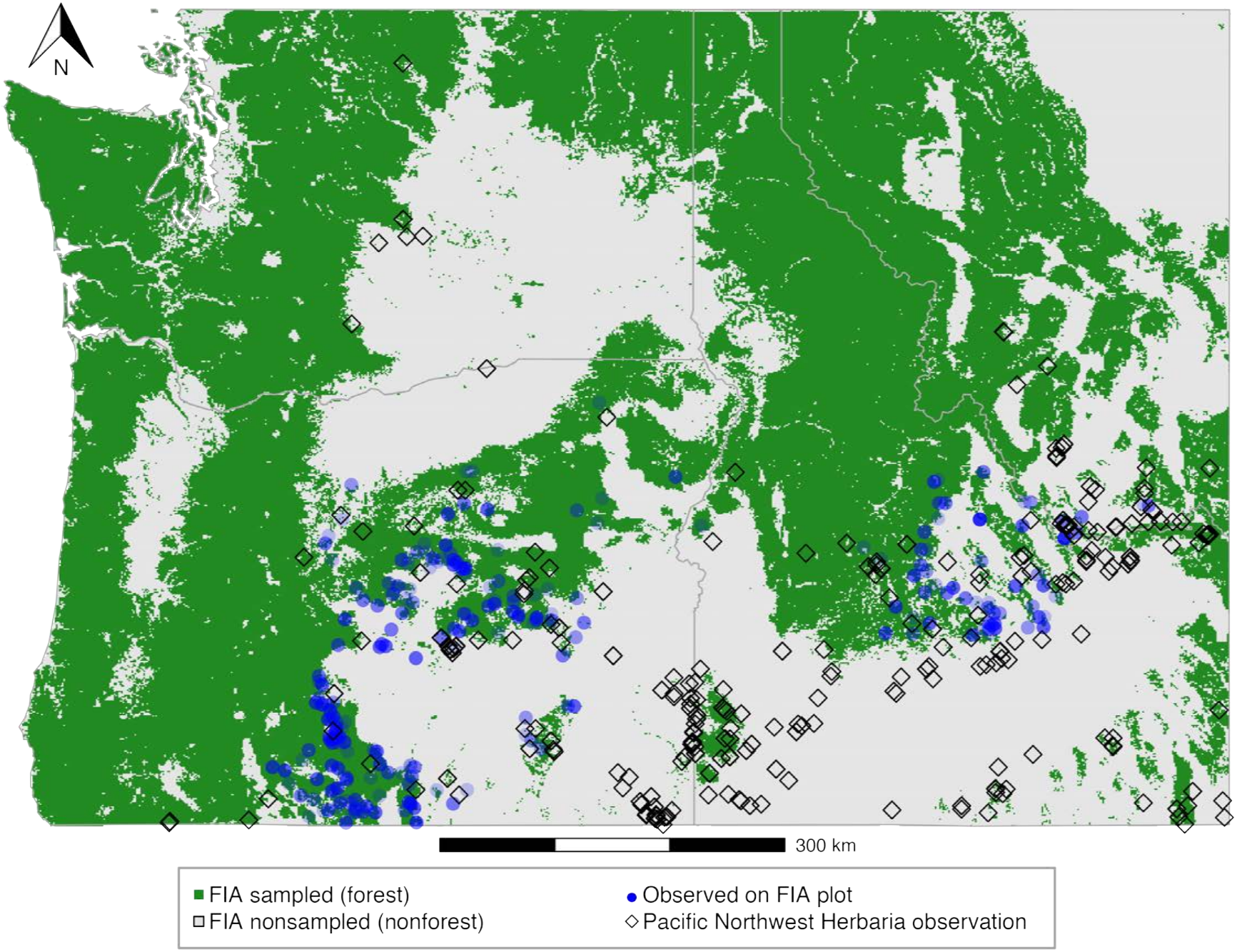
kinnikinnick, common bearberry (n = 1460)

Arctostaphylos uva–ursi



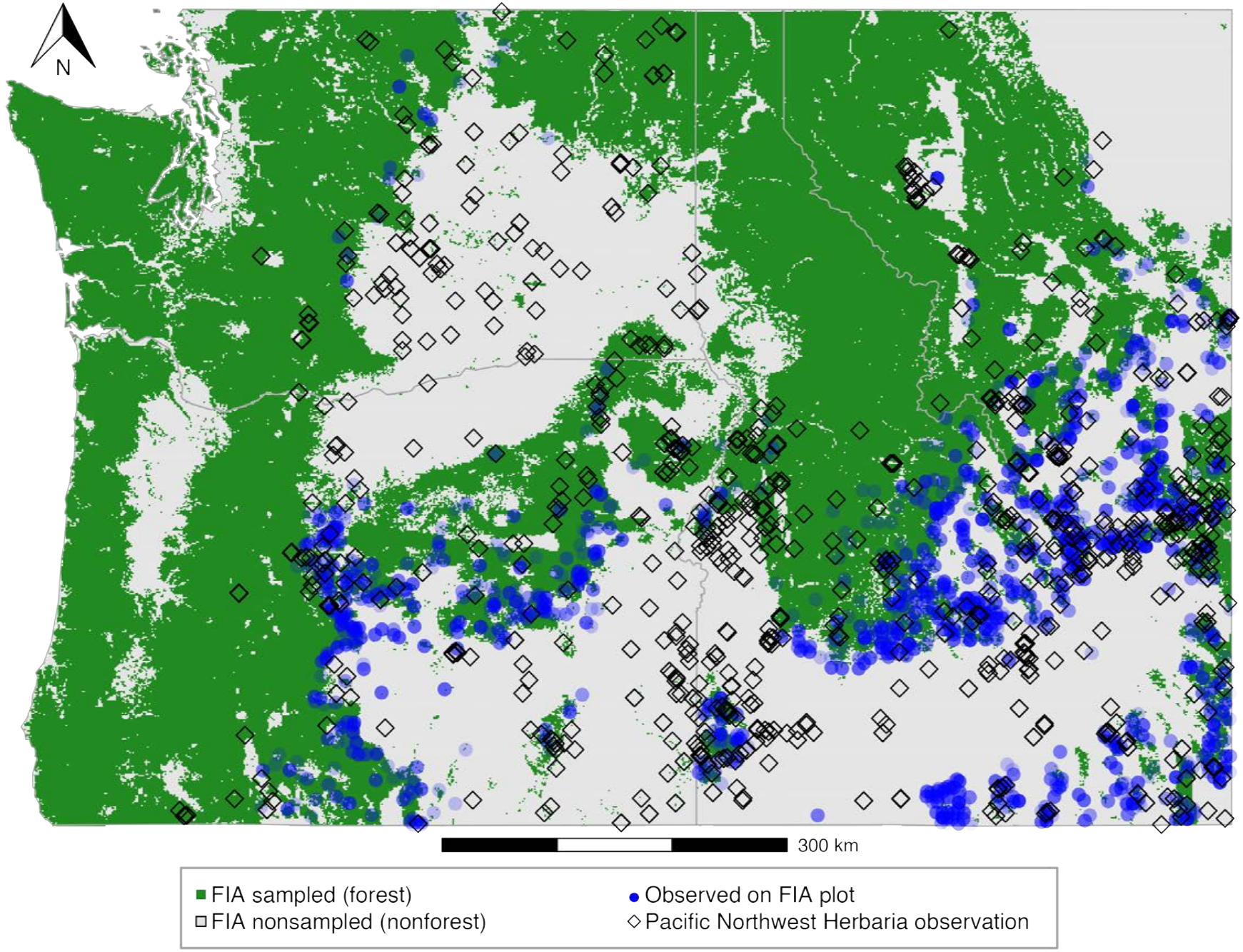
little sagebrush (n = 581)

Artemisia arbuscula



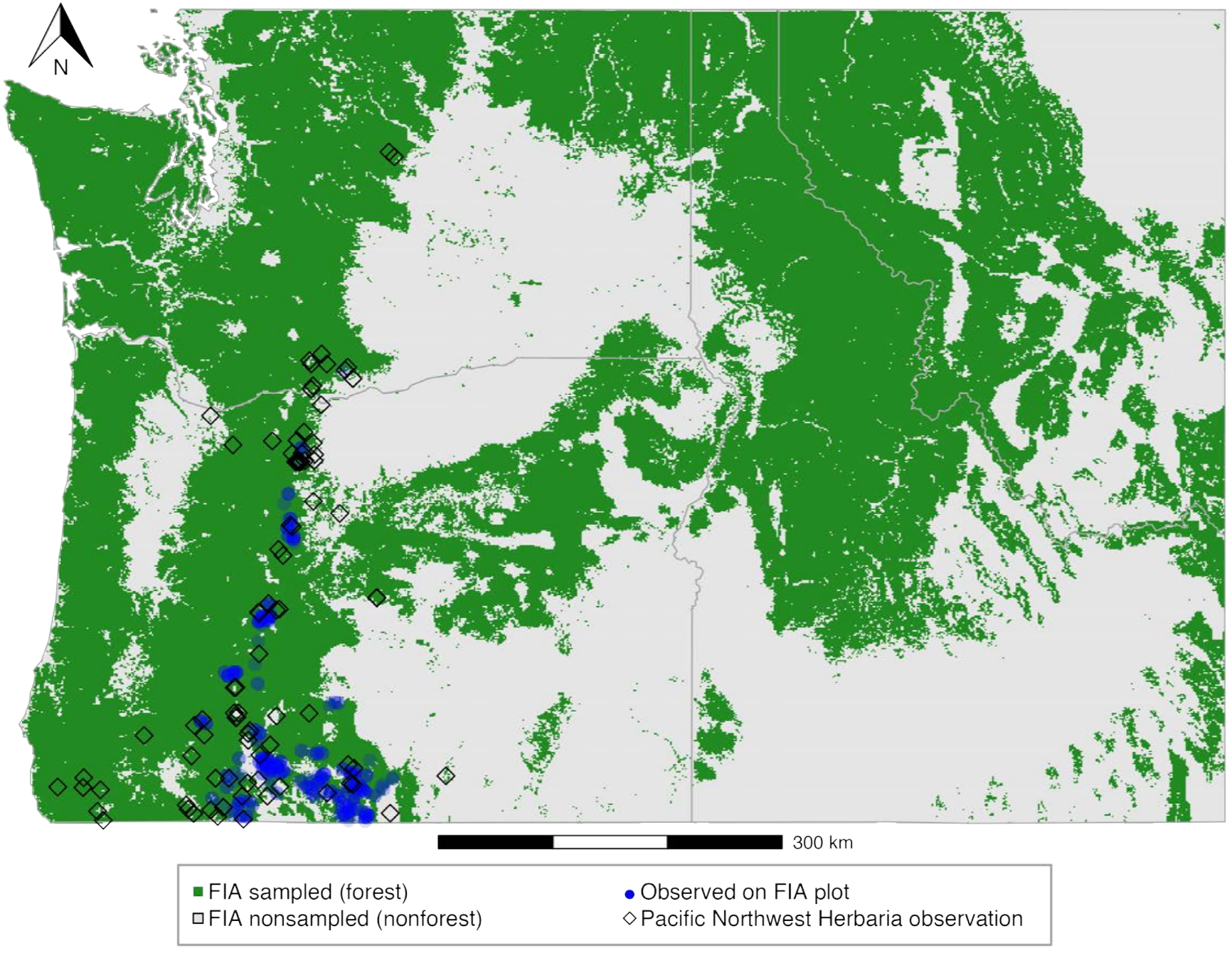
big sagebrush (n = 2035)

Artemisia tridentata

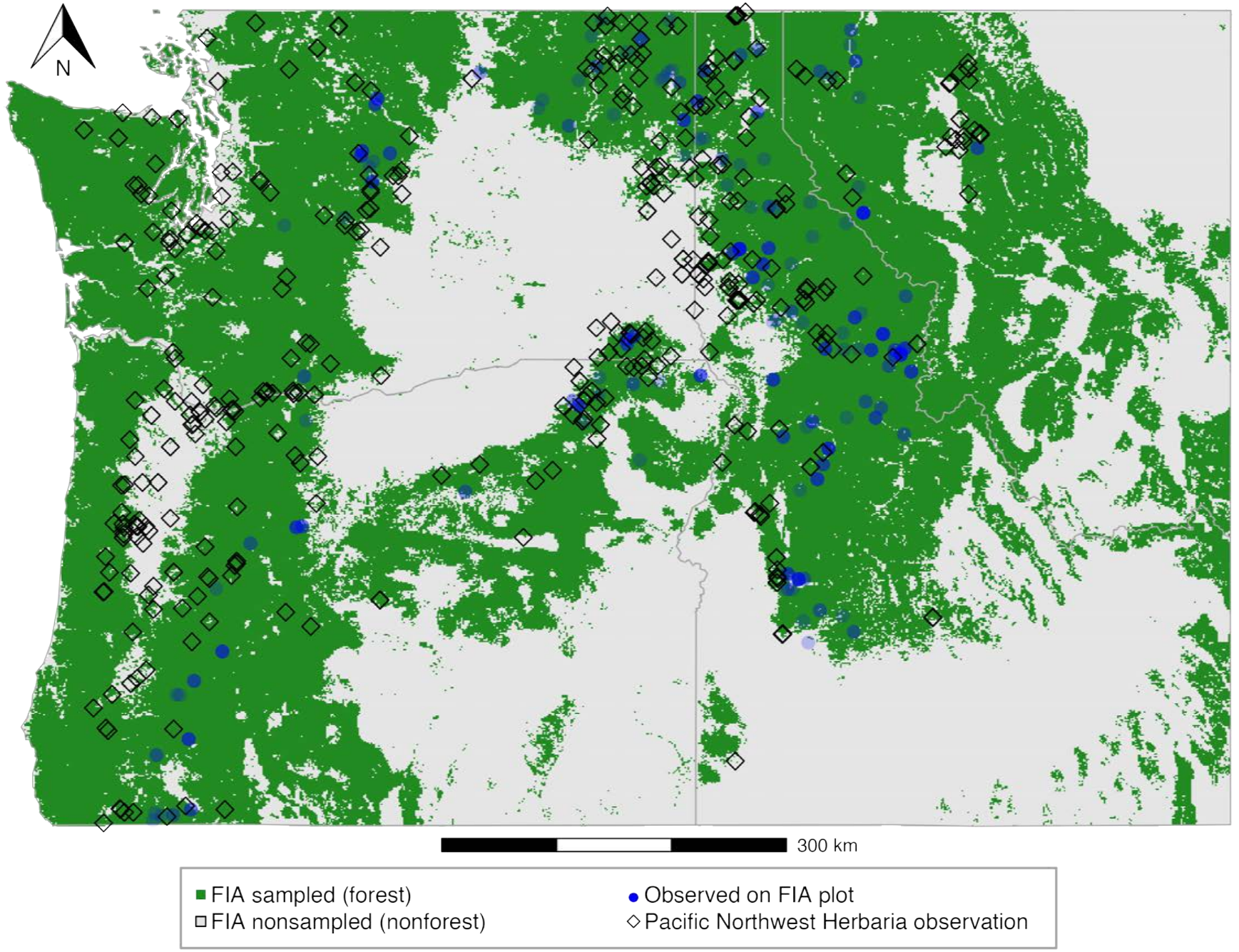


prostrate ceanothus (n = 259)

Ceanothus prostratus

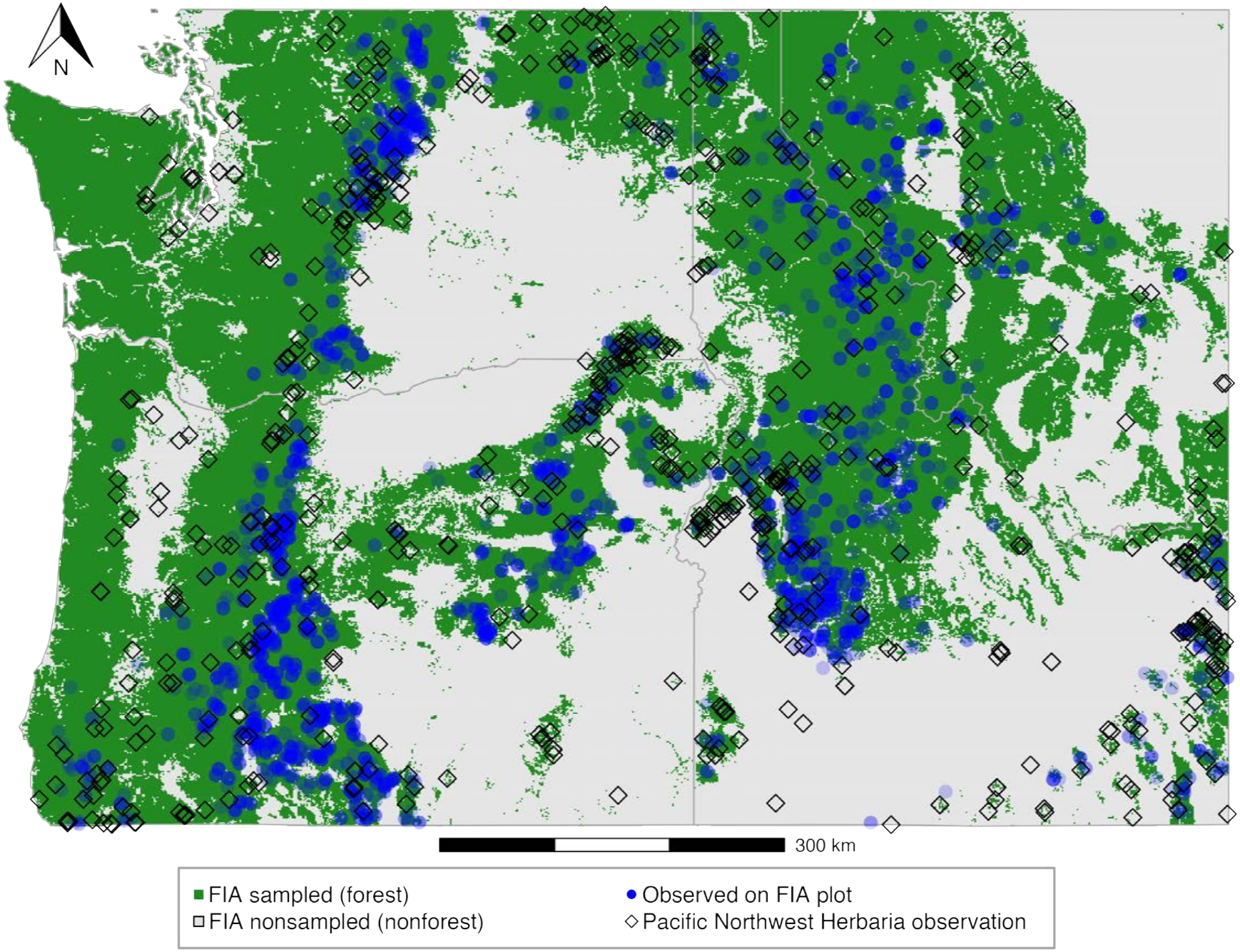


redstem ceanothus (n = 601)
Ceanothus sanguineus



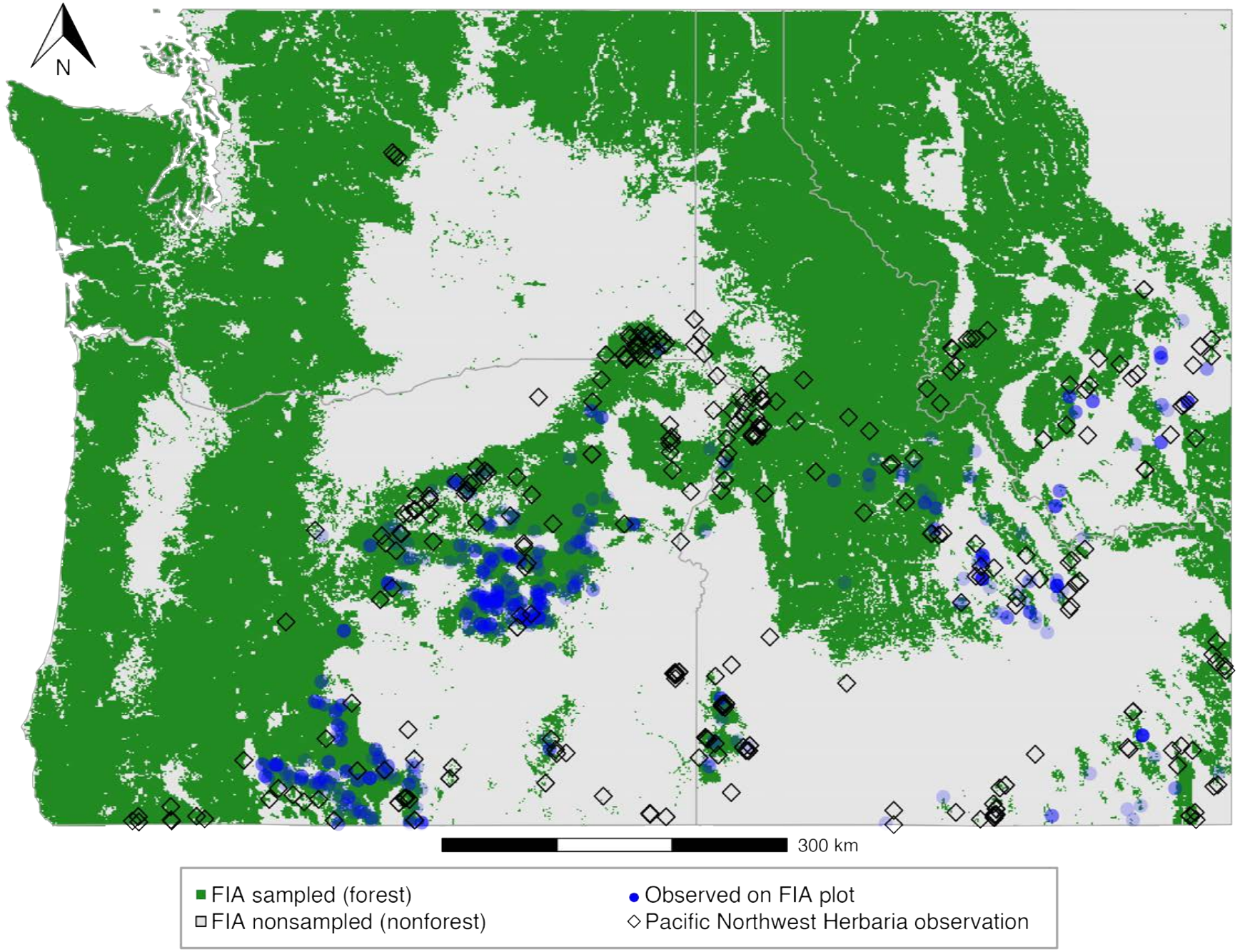
snowbrush ceanothus (n = 1828)

Ceanothus velutinus

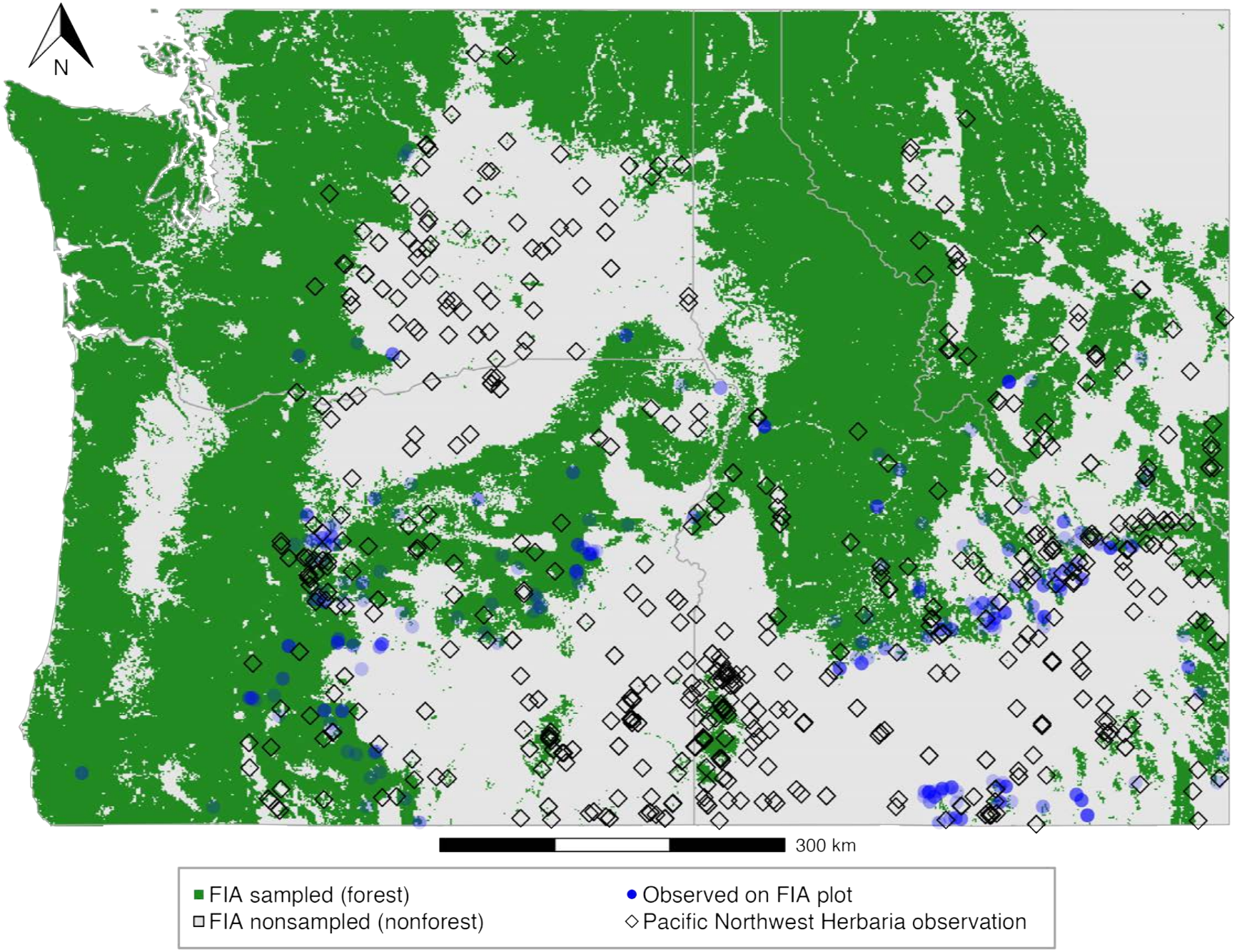


curl–leaf mountain mahogany (n = 664)

Cercocarpus ledifolius

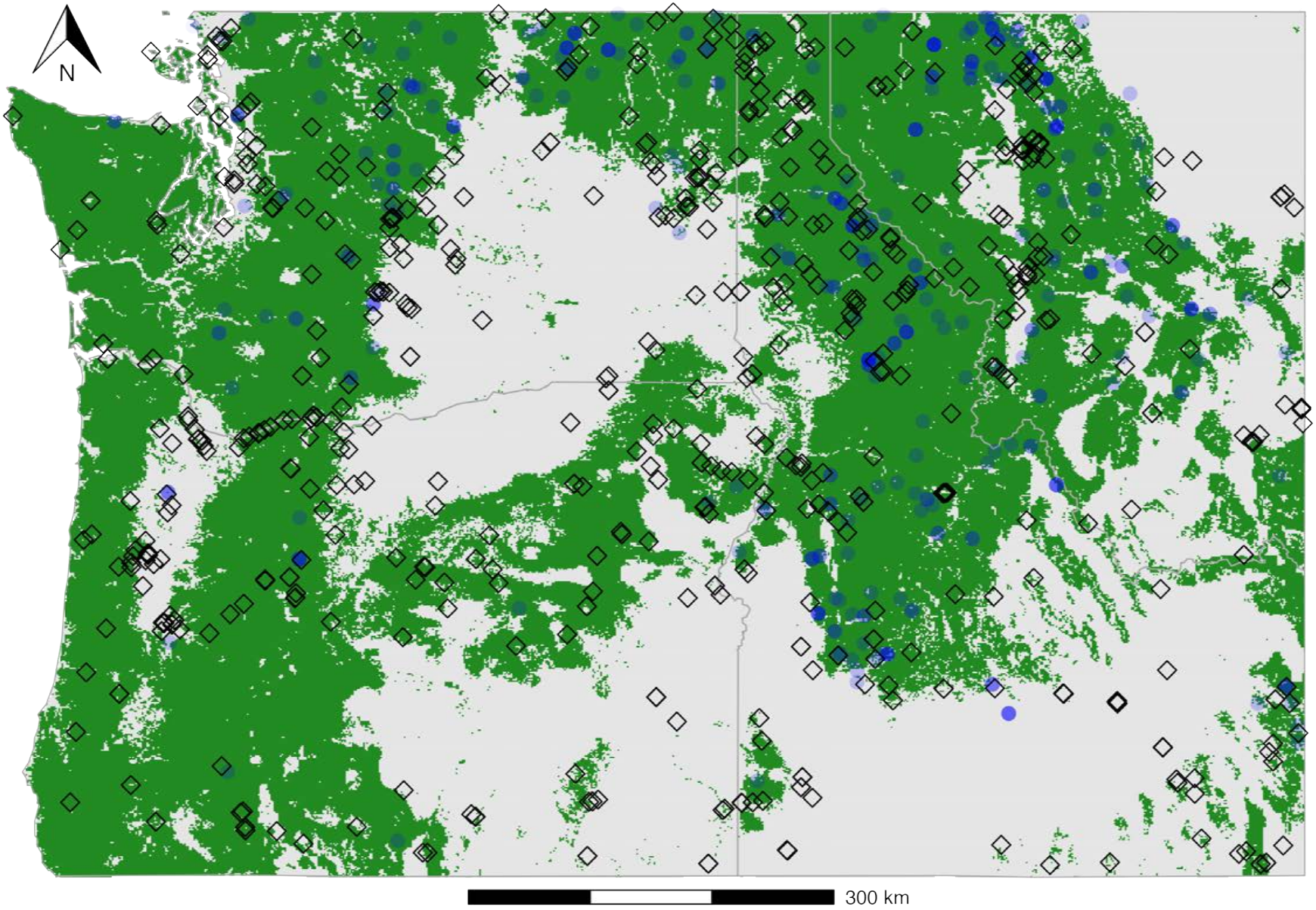


yellow rabbitbrush (n = 857)
Chrysothamnus viscidiflorus



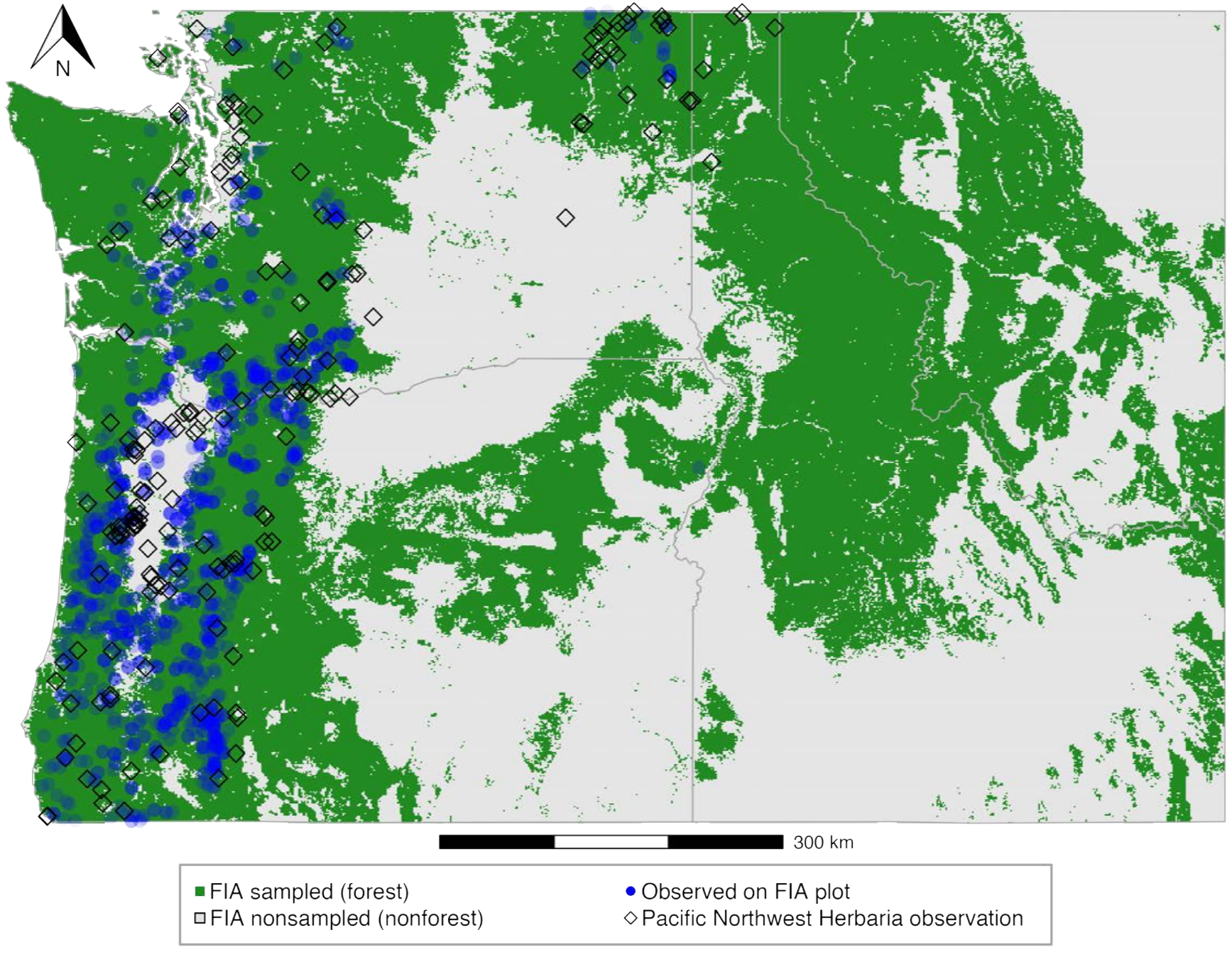
redosier dogwood (n = 868)

Cornus sericea

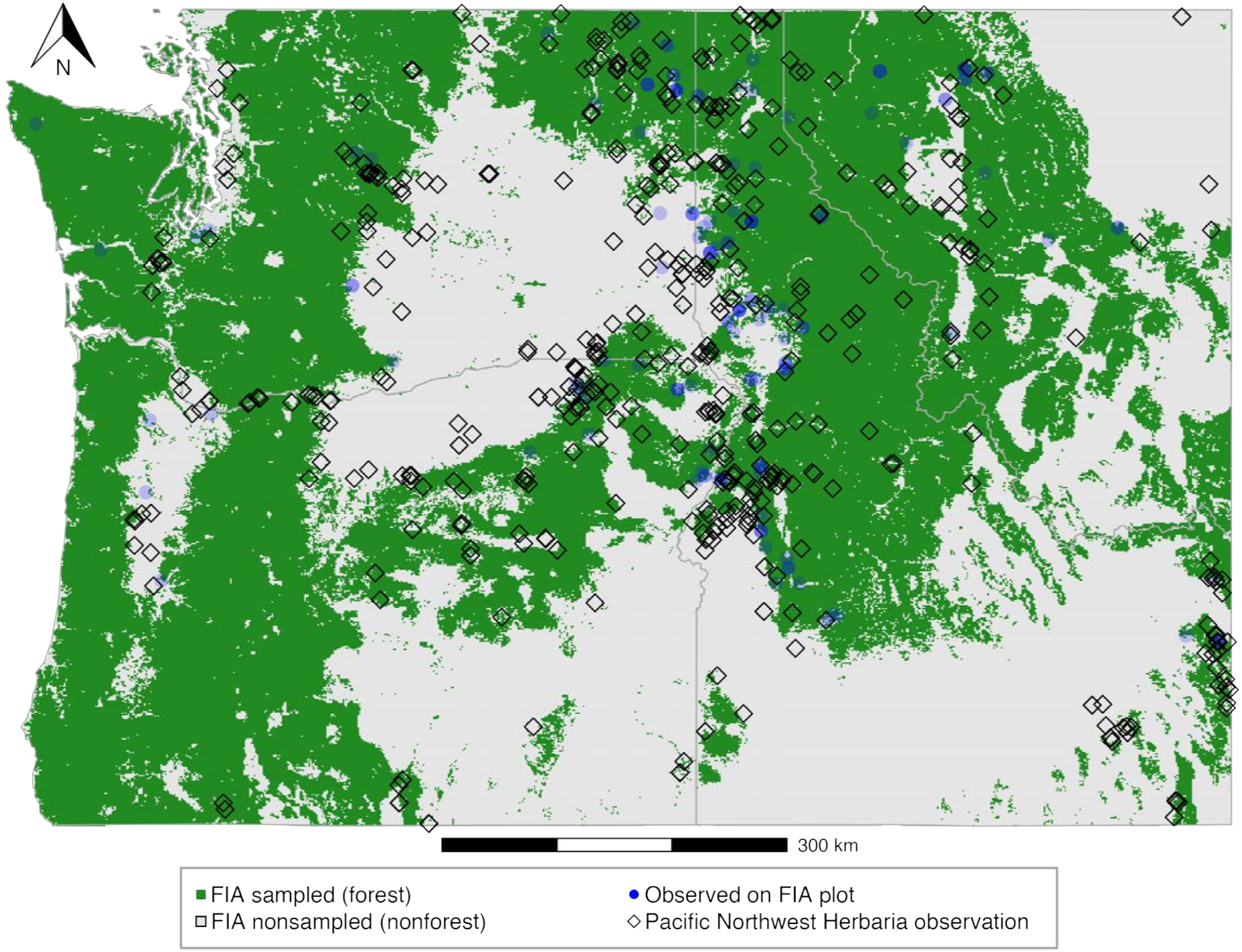


beaked hazelnut, California hazelnut (n = 910)

Corylus cornuta

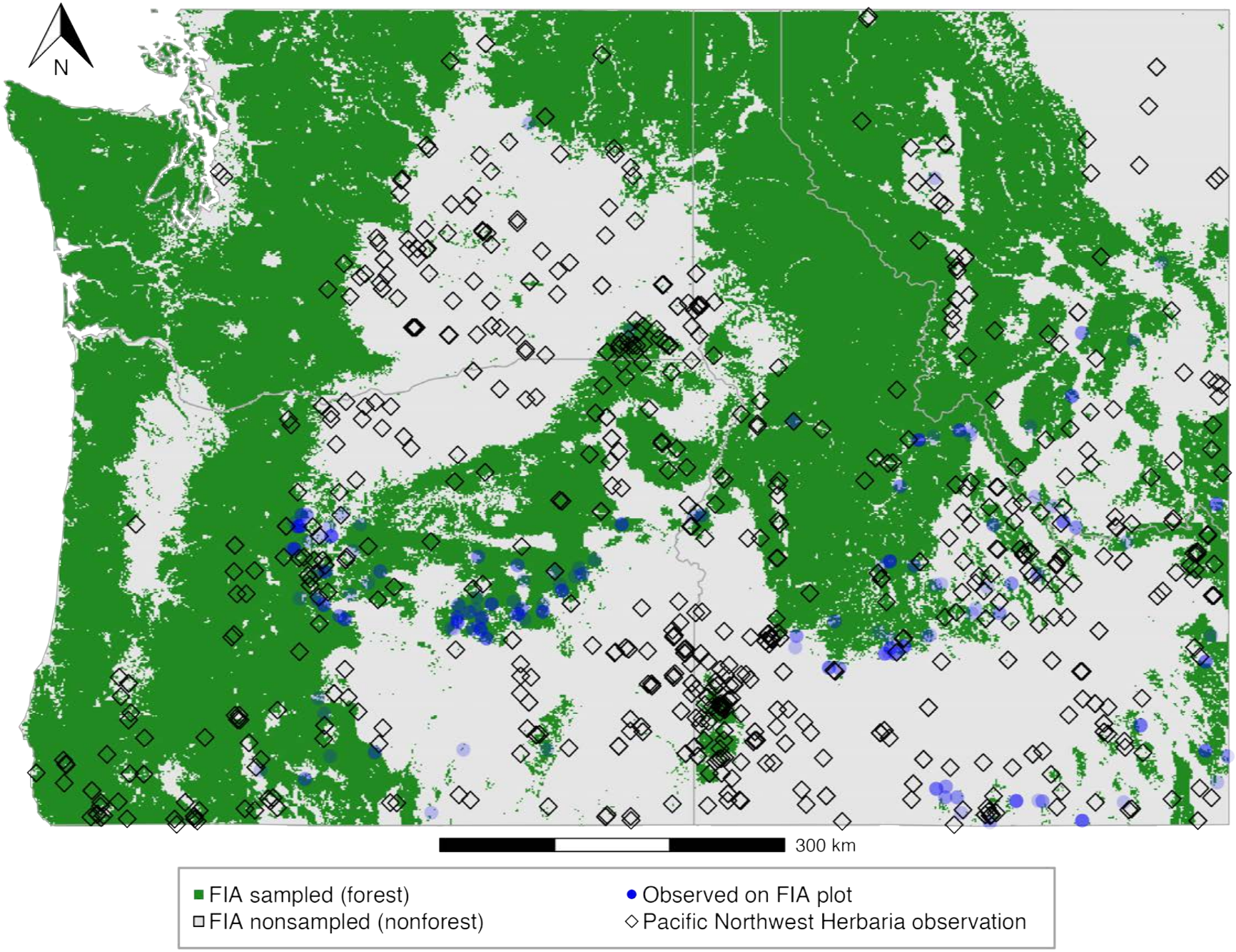


black hawthorn (n = 641)
Crataegus douglasii

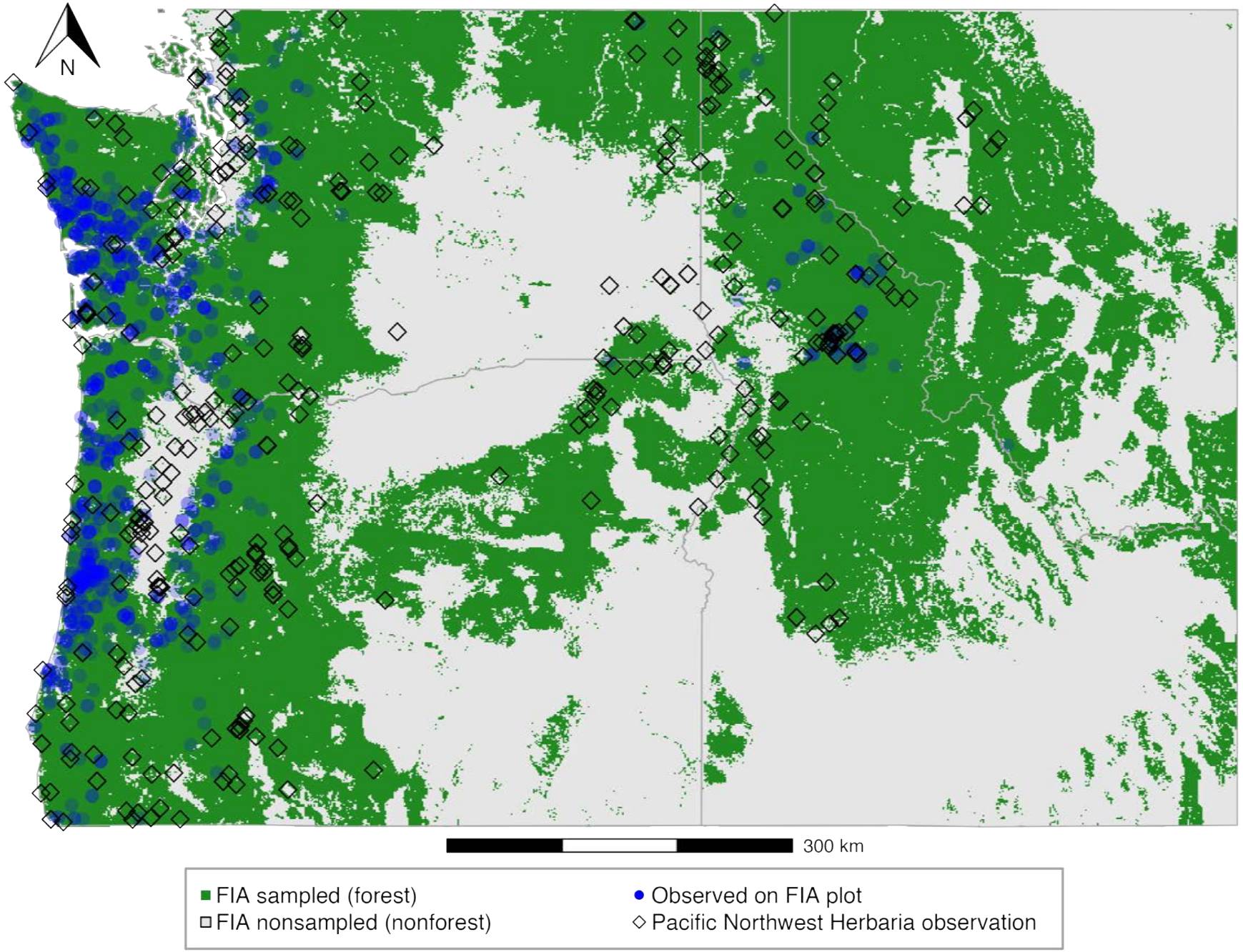


rubber rabbitbrush (n = 941)

Ericameria nauseosa

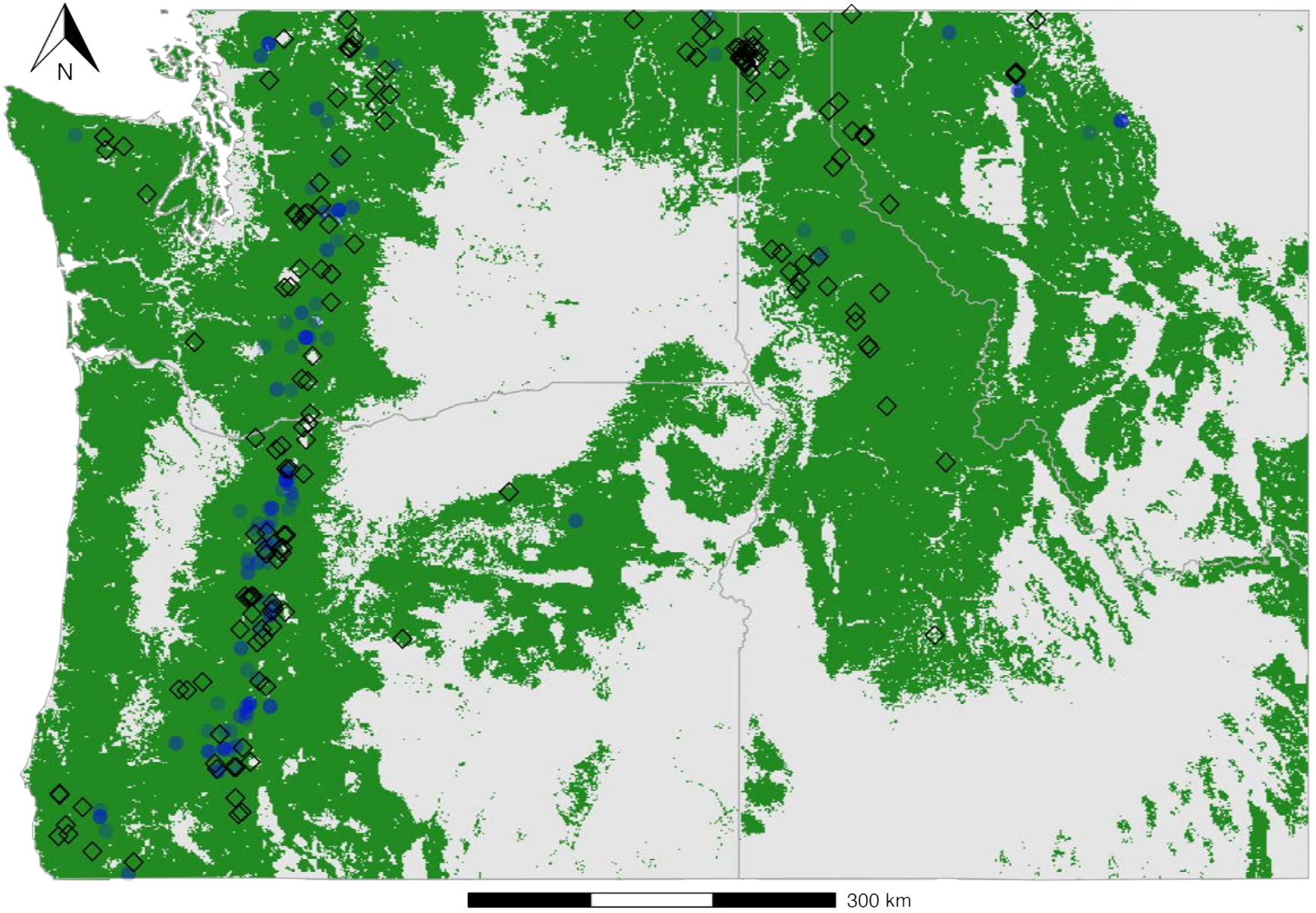


Cascara buckthorn (n = 912)
Frangula purshiana



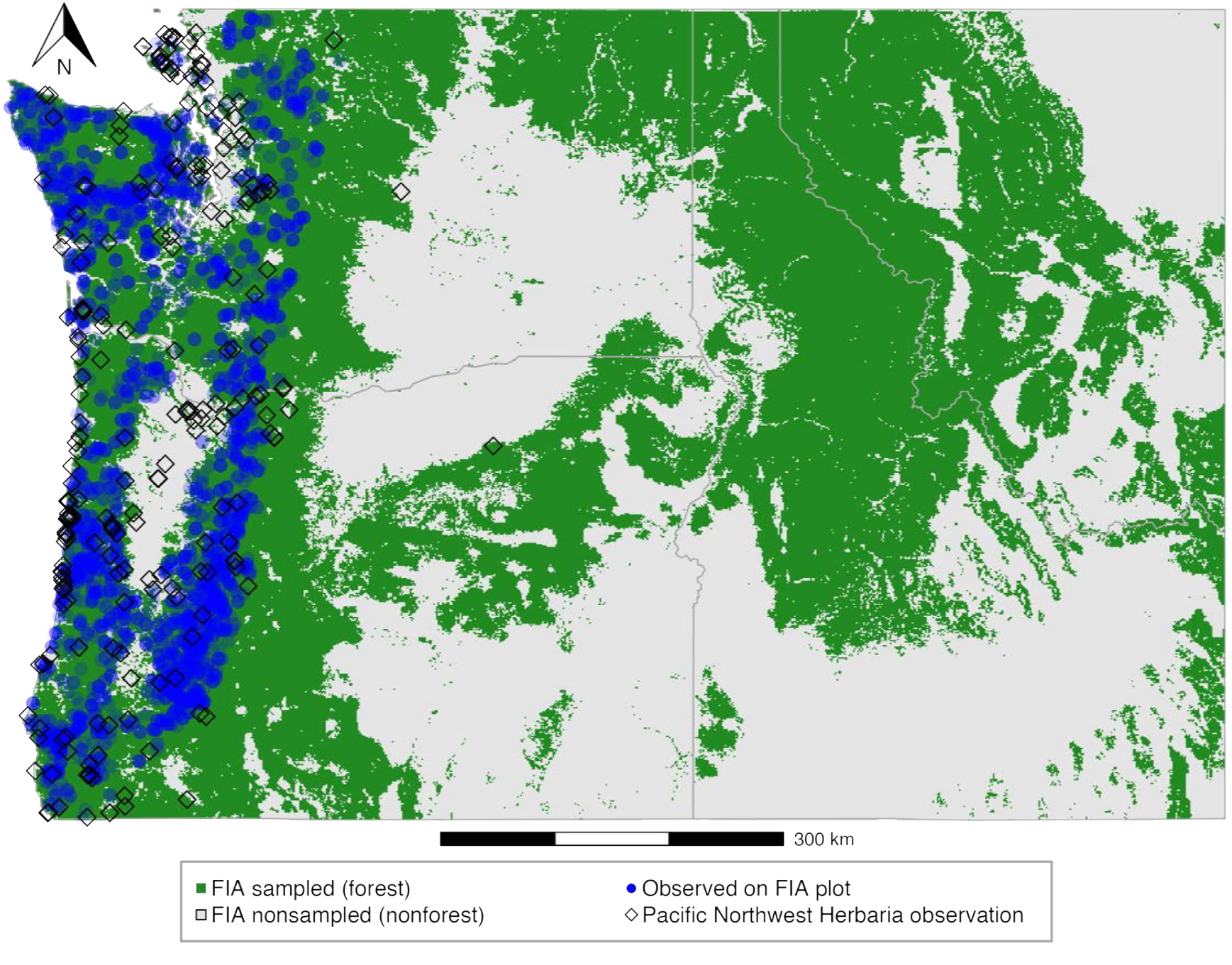
western teaberry (n = 272)

Gaultheria ovatifolia



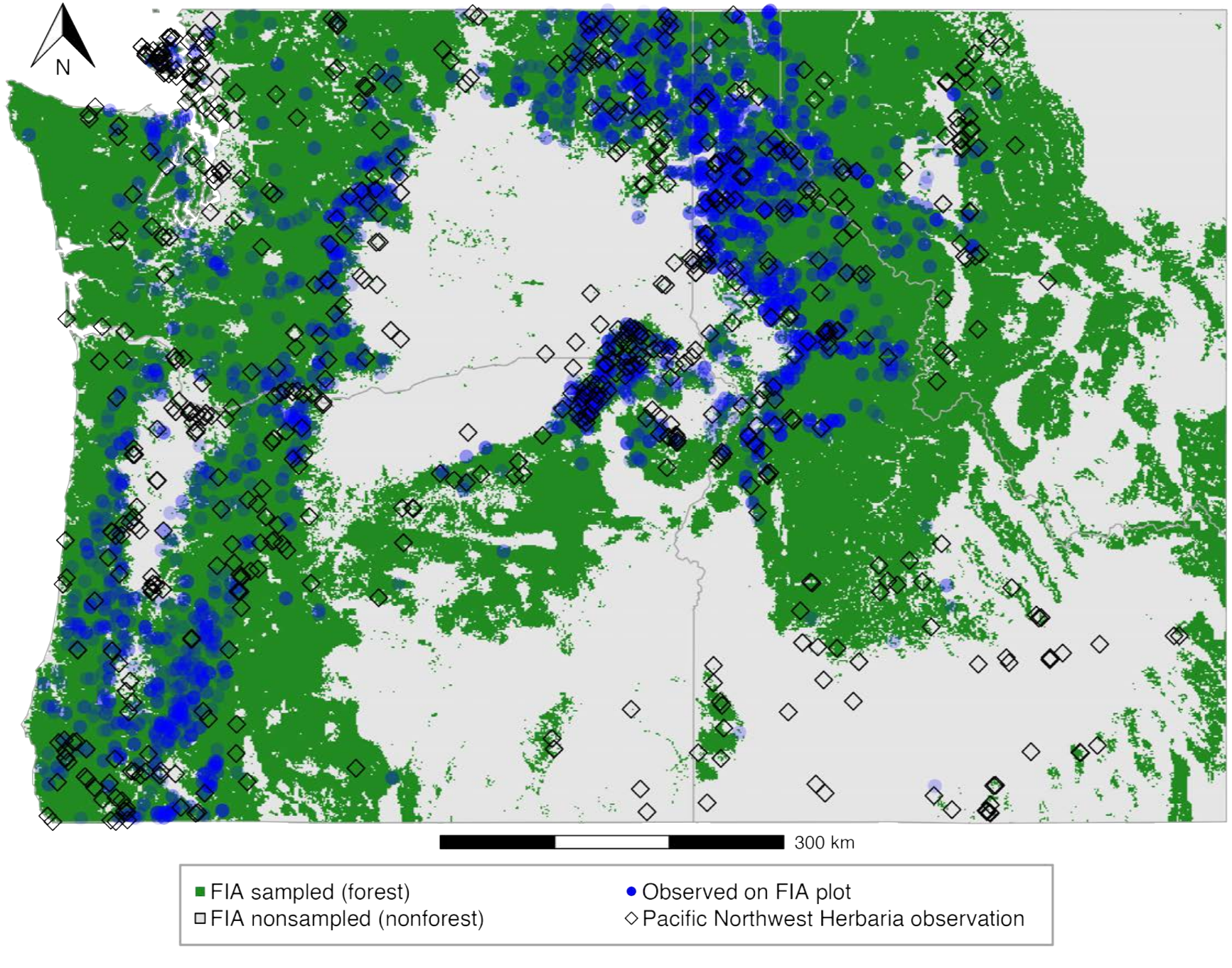
salal (n = 1573)

Gaultheria shallon



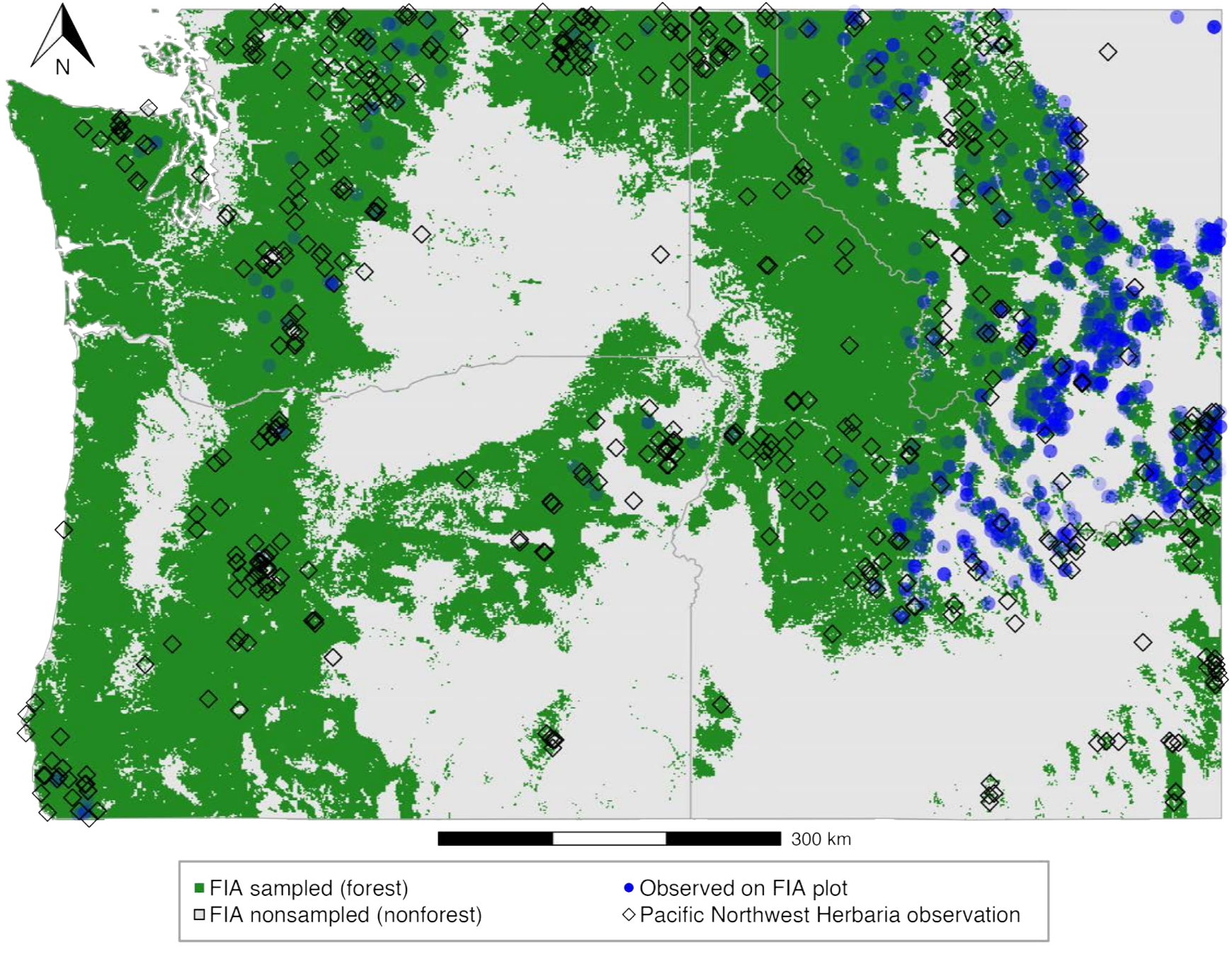
oceanspray (n = 2265)

Holodiscus discolor



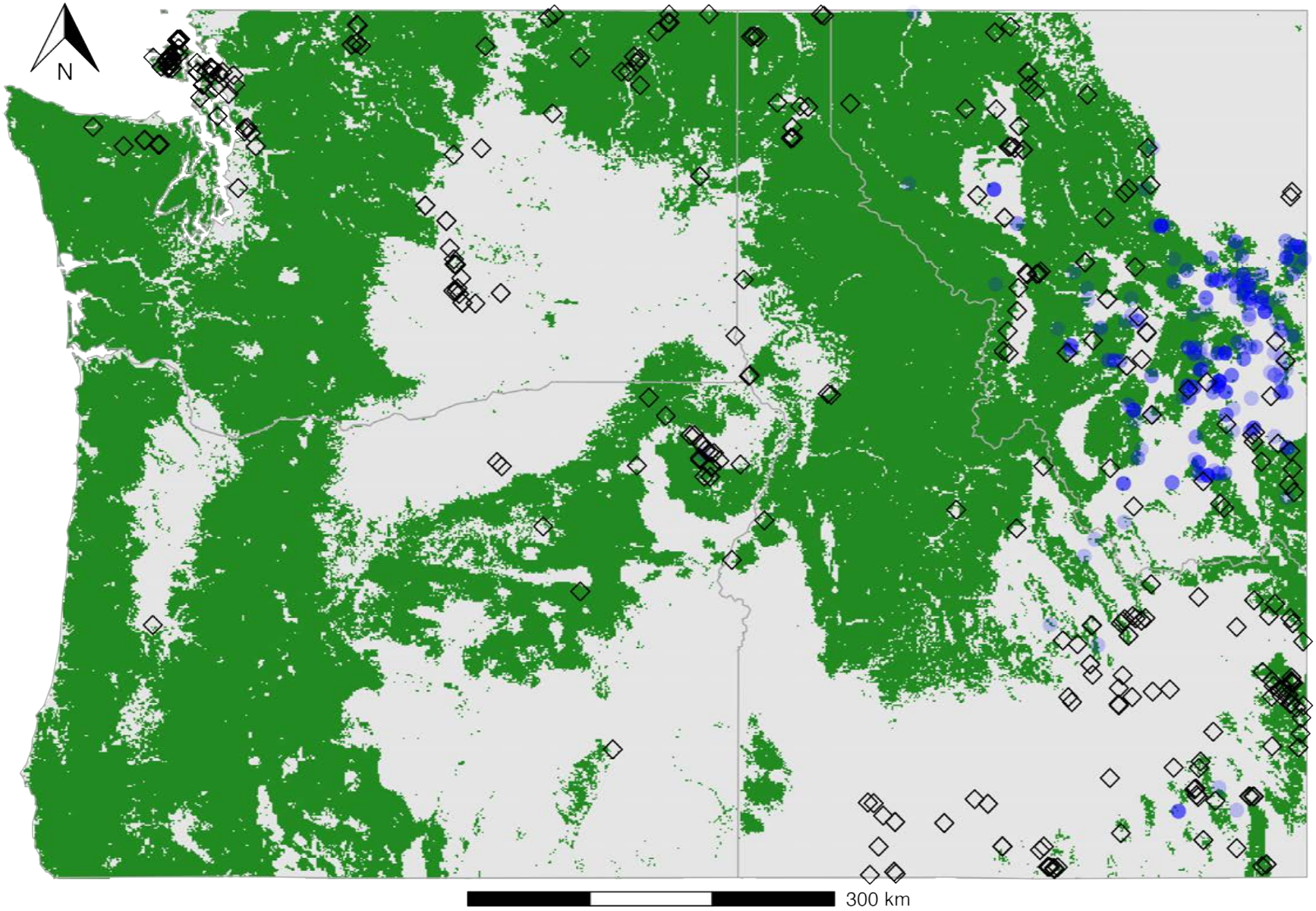
common juniper, ground juniper (n = 1133)

Juniperus communis

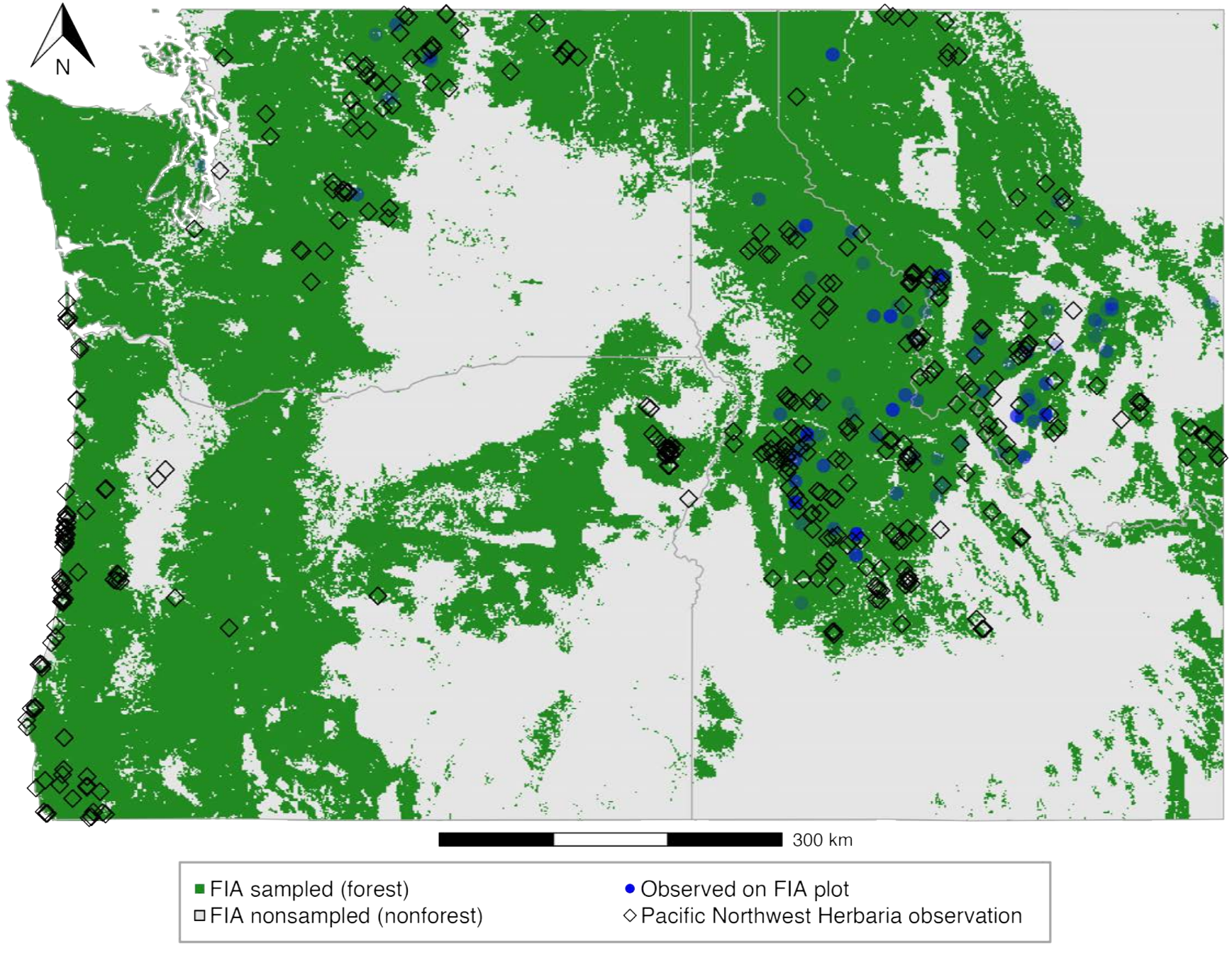


Rocky Mountain juniper (n = 554)

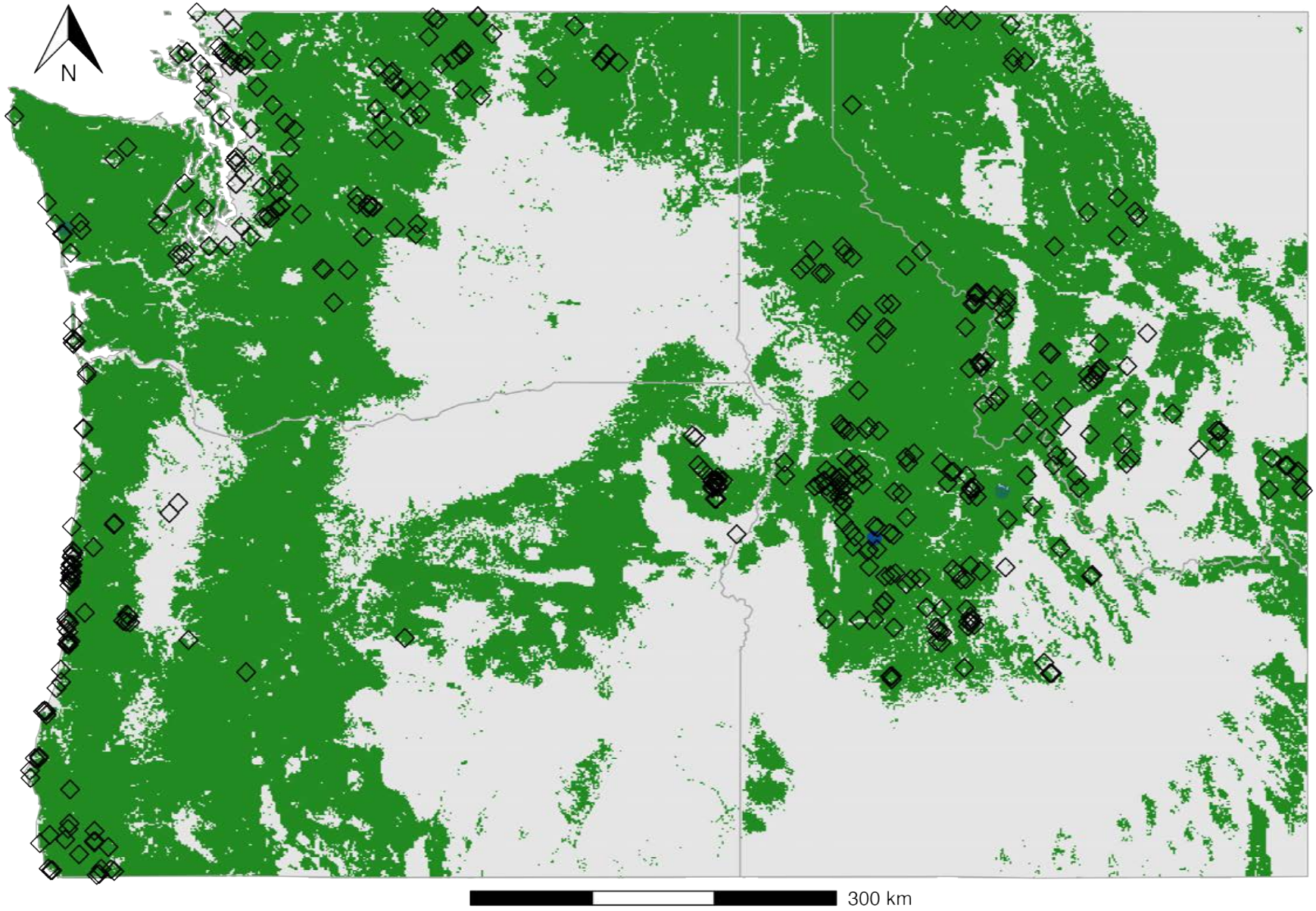
Juniperus scopulorum



western Labrador tea (n = 550)
Ledum glandulosum

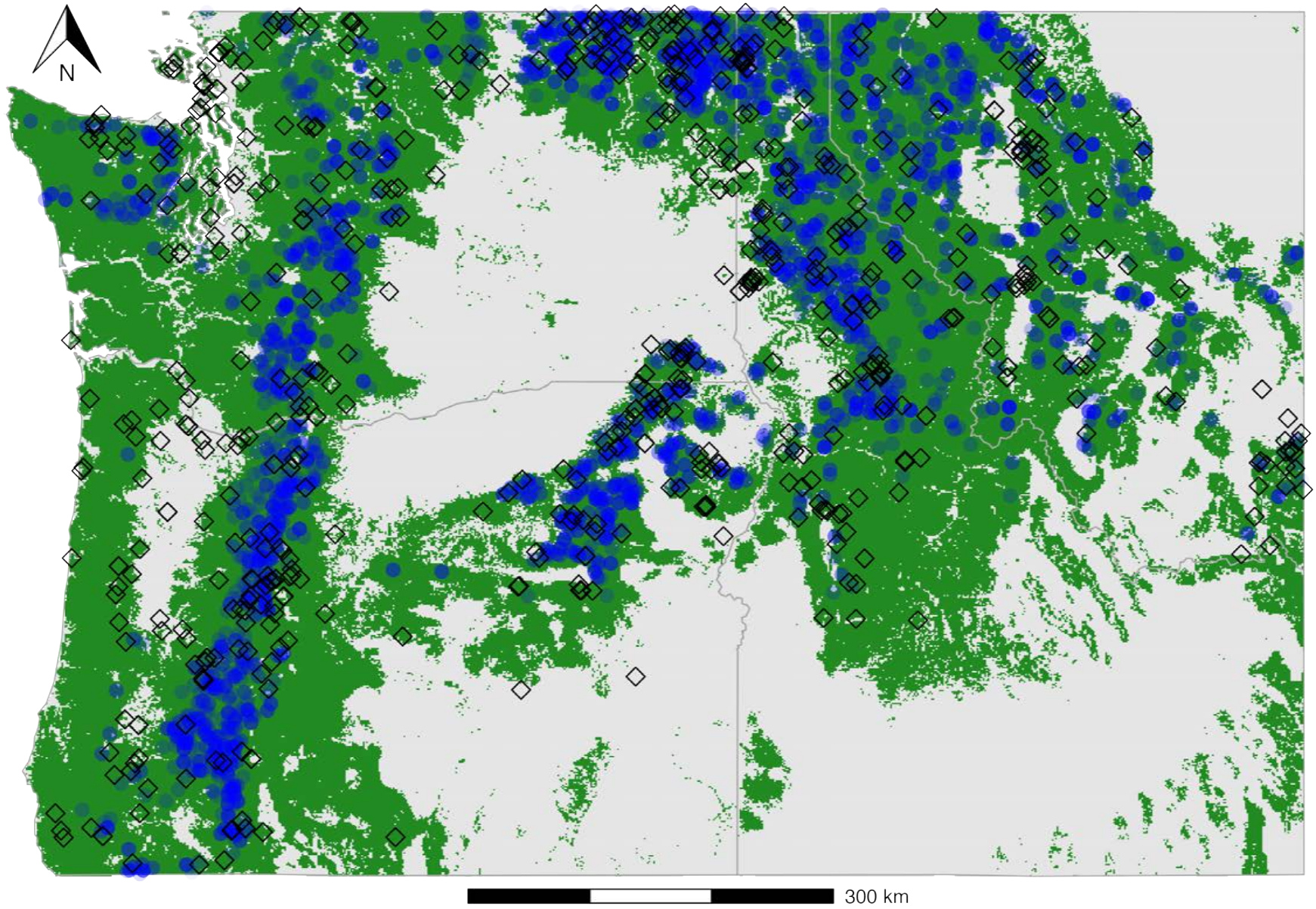


bog Labrador tea (n = 576)
Ledum groenlandicum



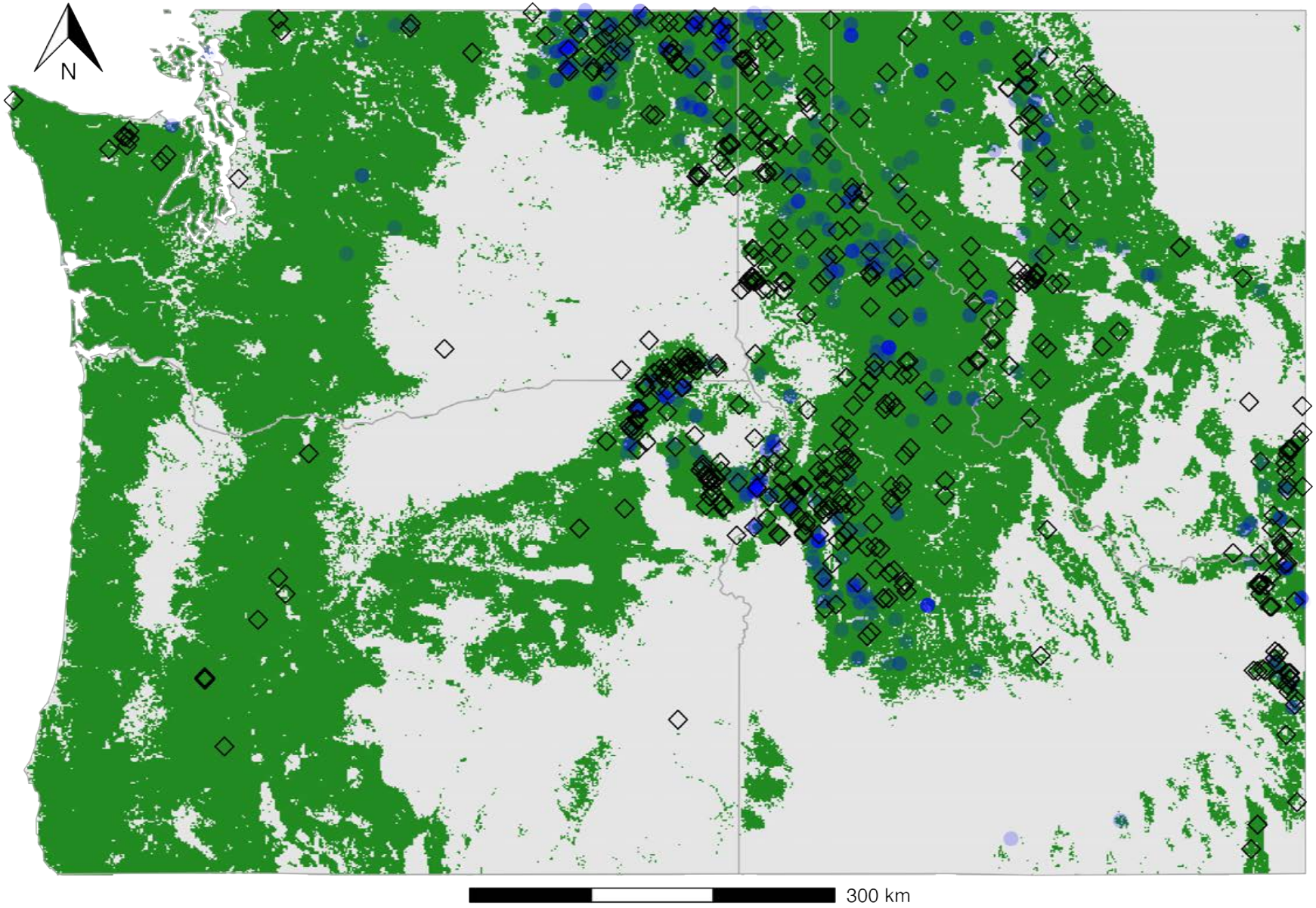
twinflower (n = 2407)

Linnaea borealis



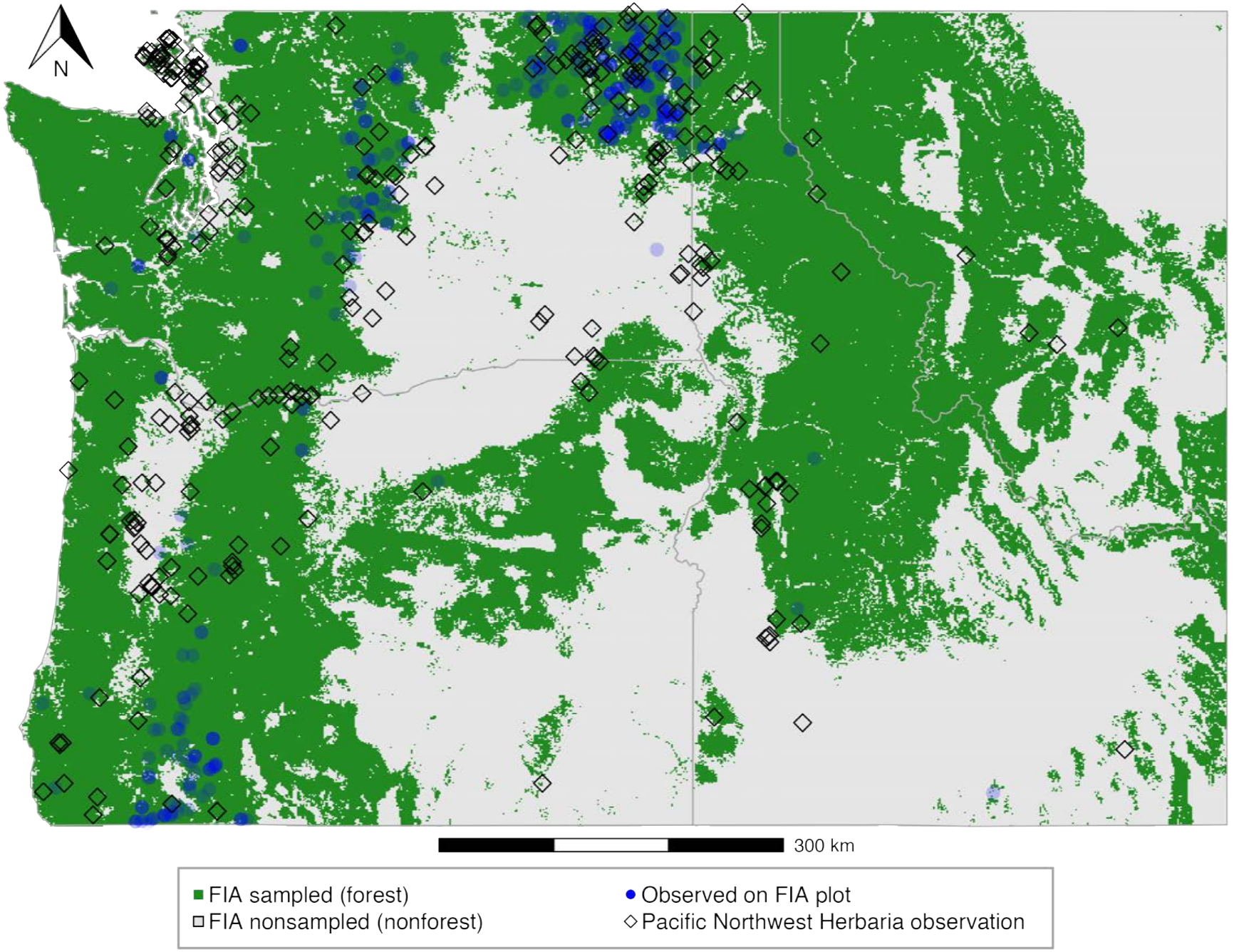
Utah honeysuckle (n = 846)

Lonicera utahensis



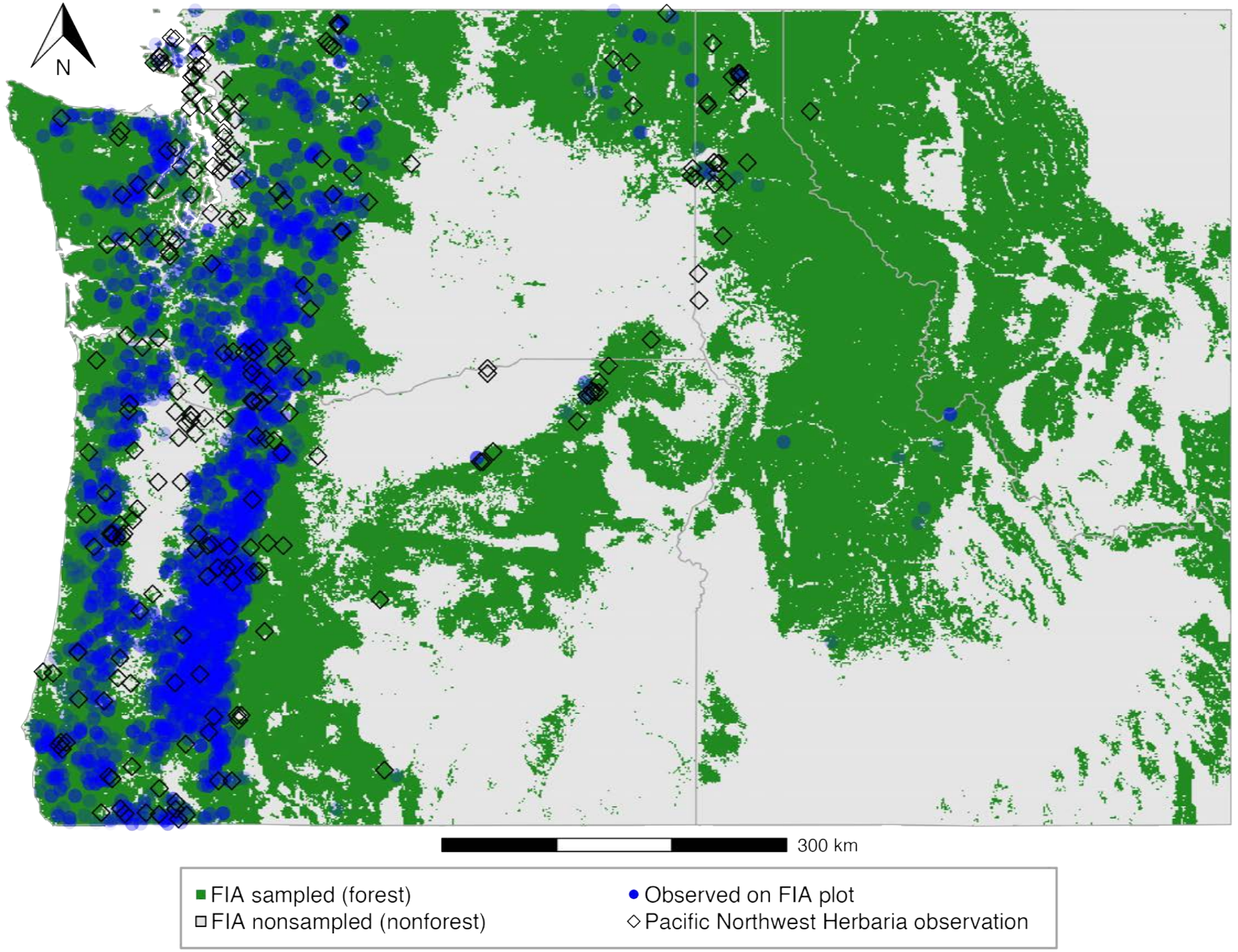
hollyleaved barberry, tall Oregon–grape (n = 595)

Mahonia aquifolium

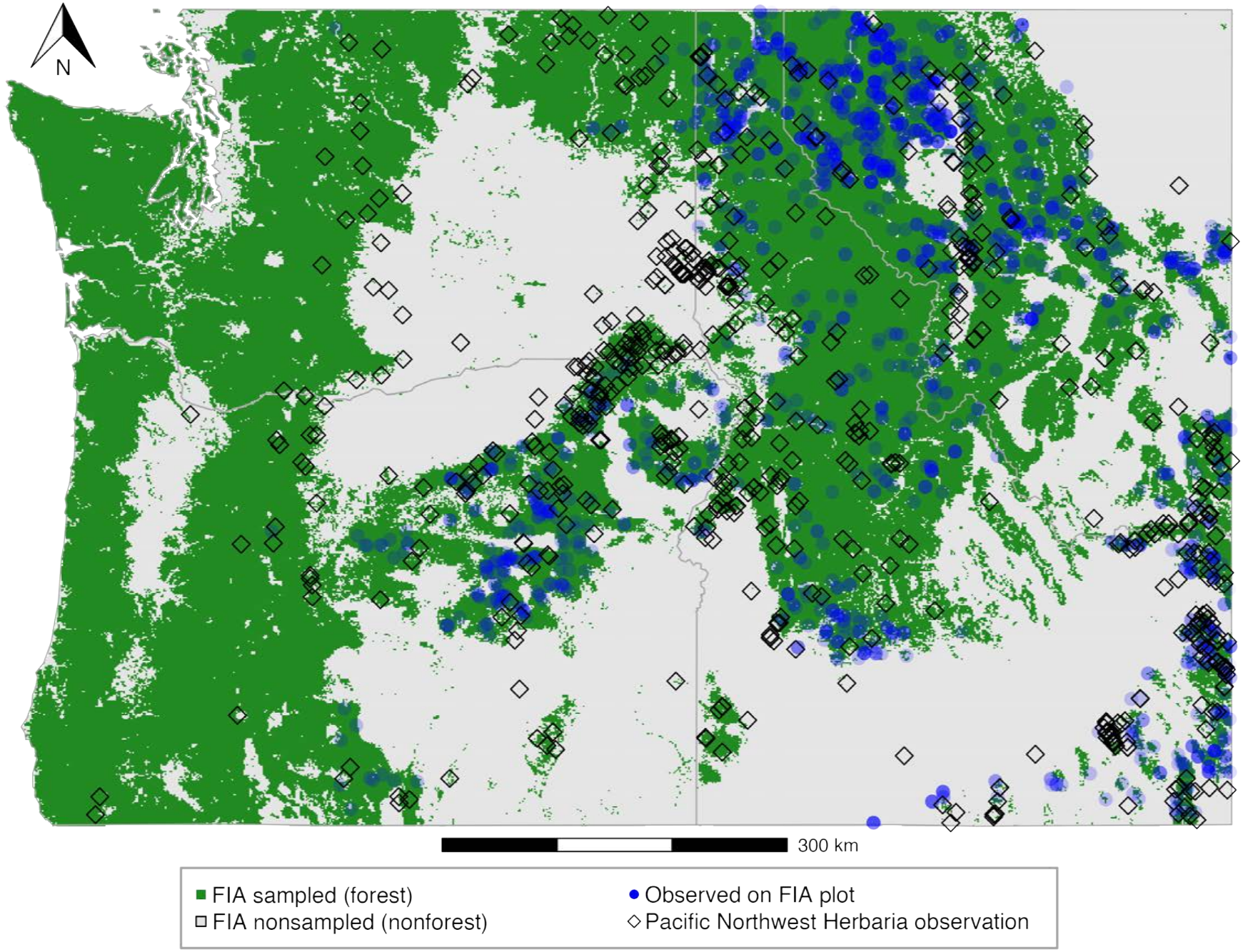


Cascade barberry, dull Oregon–grape (n = 1959)

Mahonia nervosa

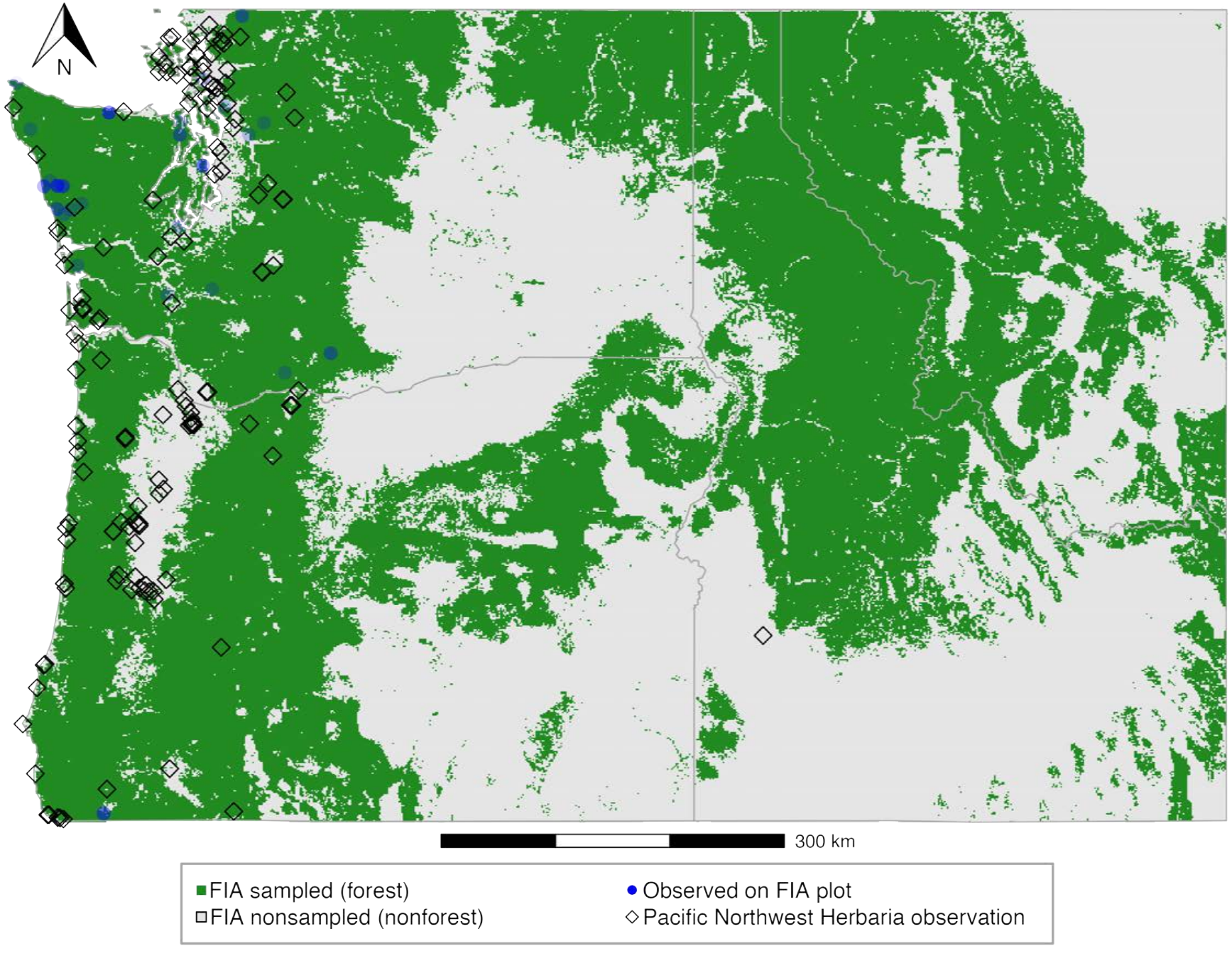


creeping barberry, creeping Oregon–grape (n = 1566)
Mahonia repens



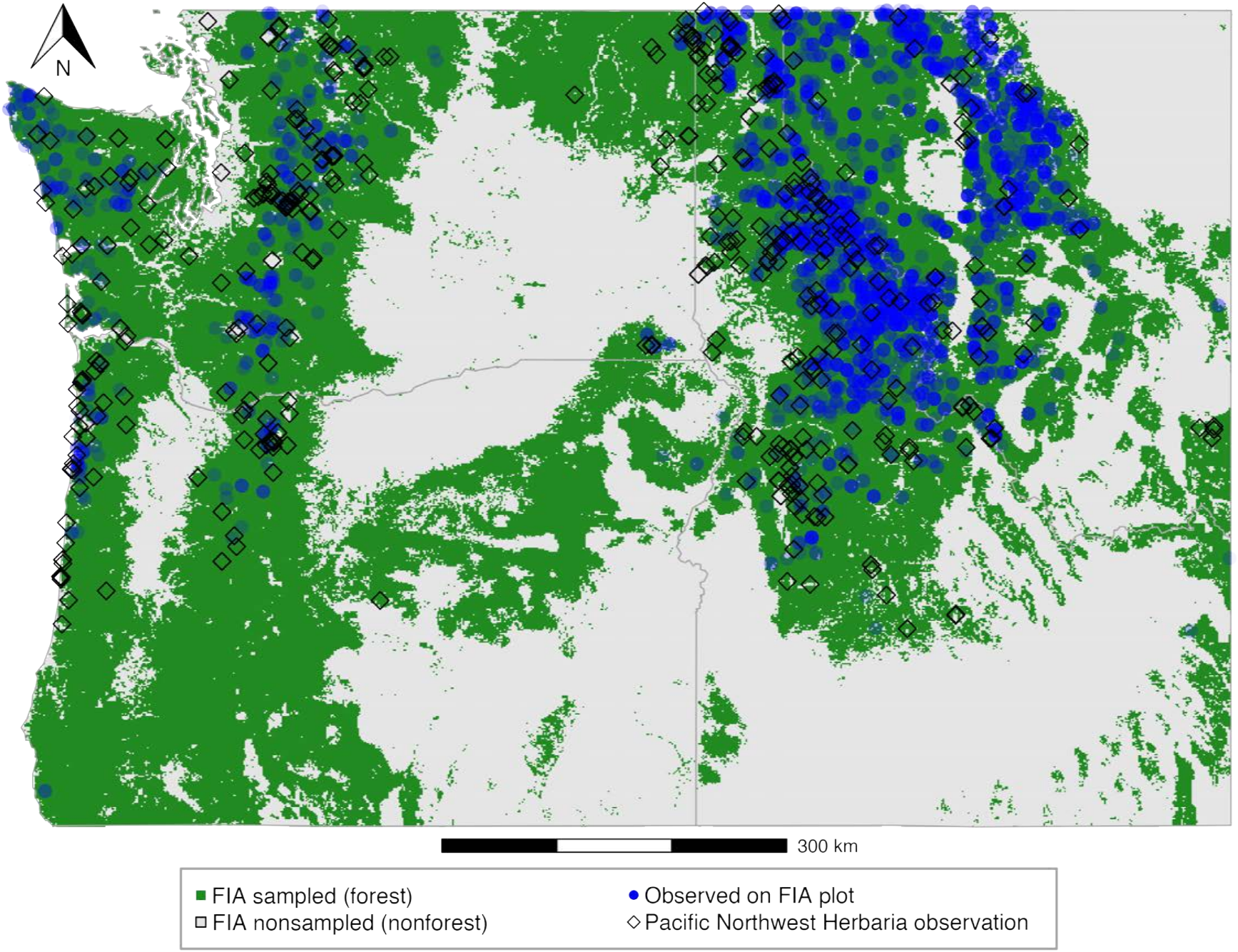
Oregon crab apple, Pacific crab apple (n = 210)

Malus fusca



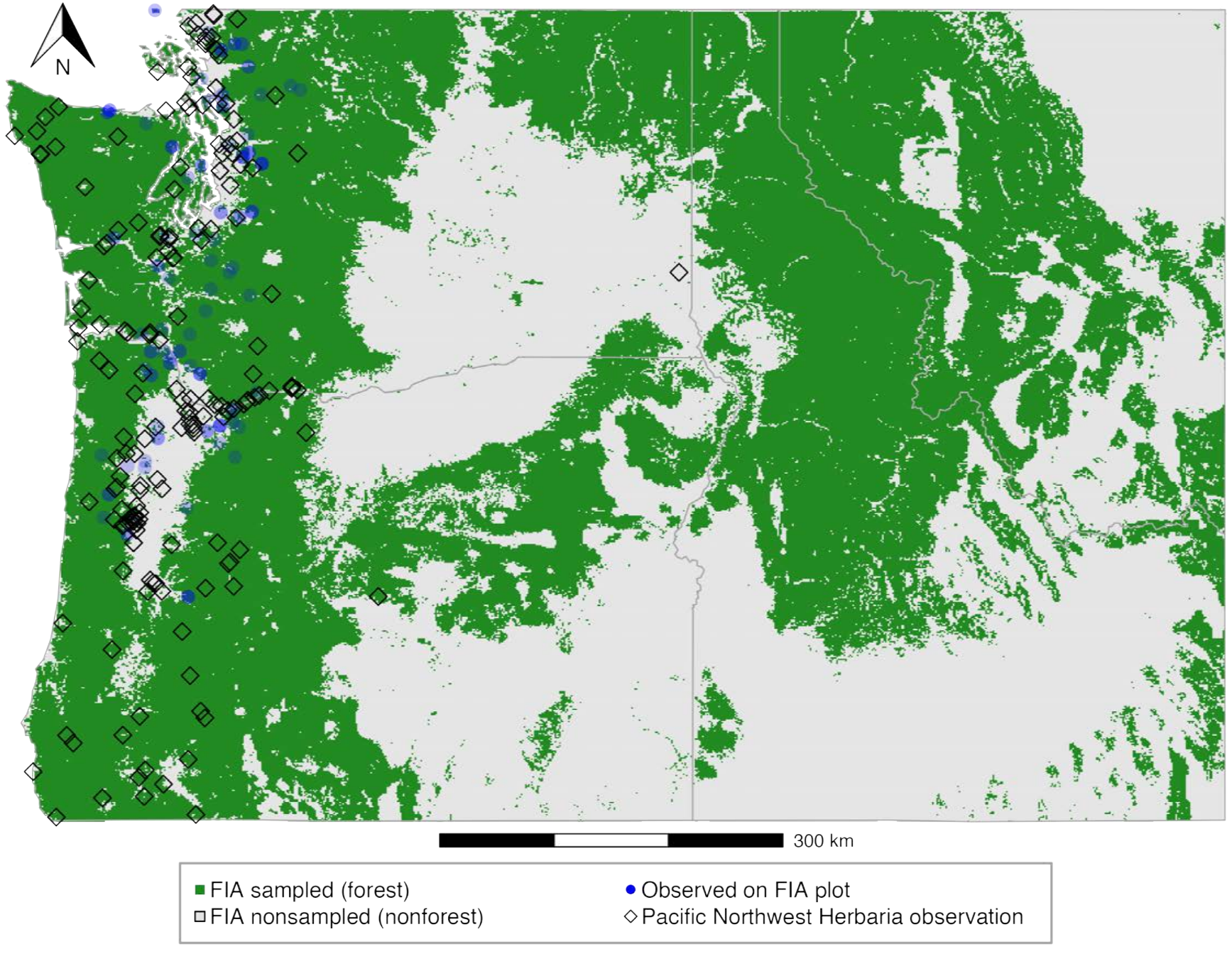
rusty menziesia, false azalea (n = 1662)

Menziesia ferruginea

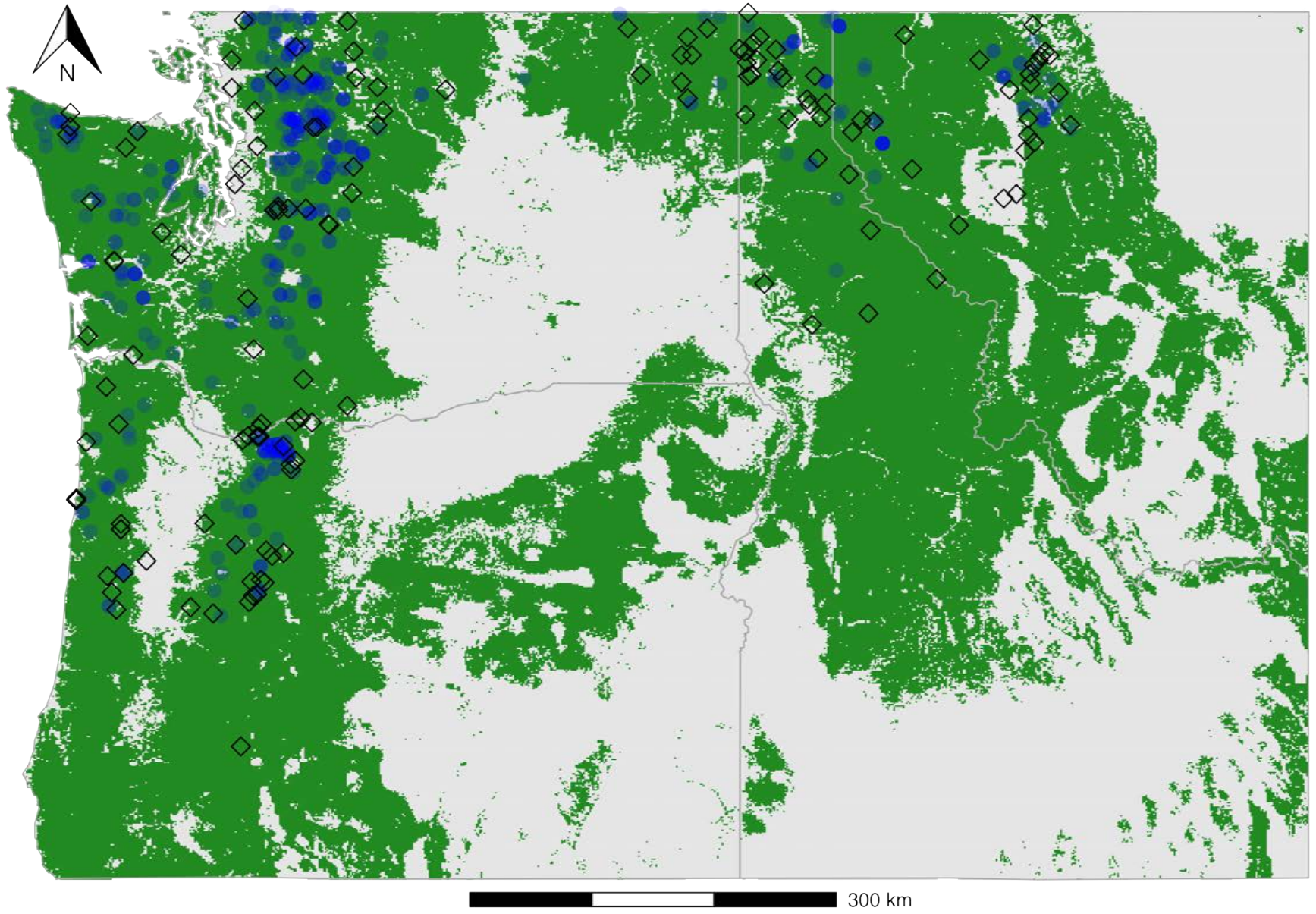


Indian plum (n = 305)

Oemleria cerasiformis

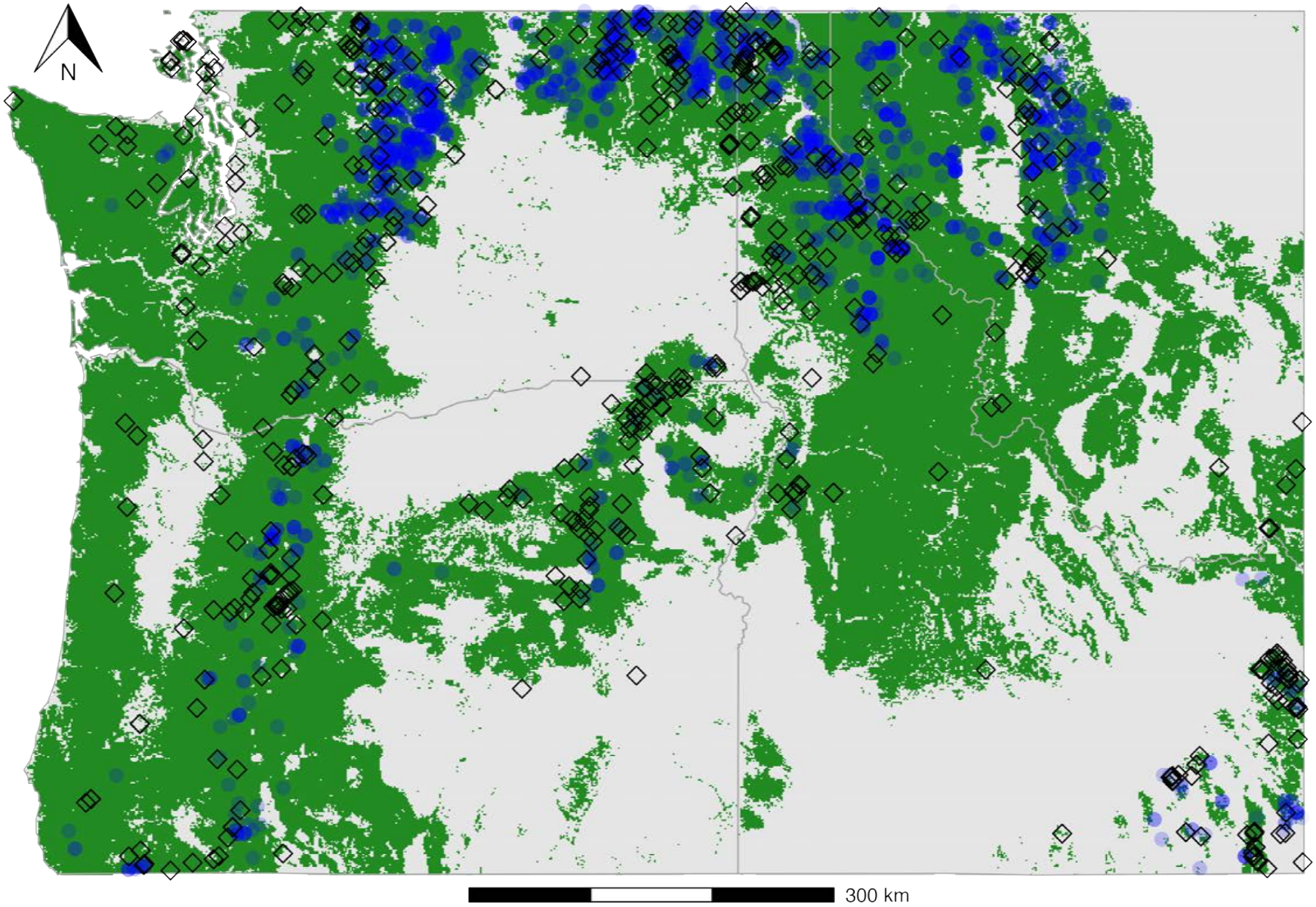


devilsclub (n = 442)
Oplopanax horridus



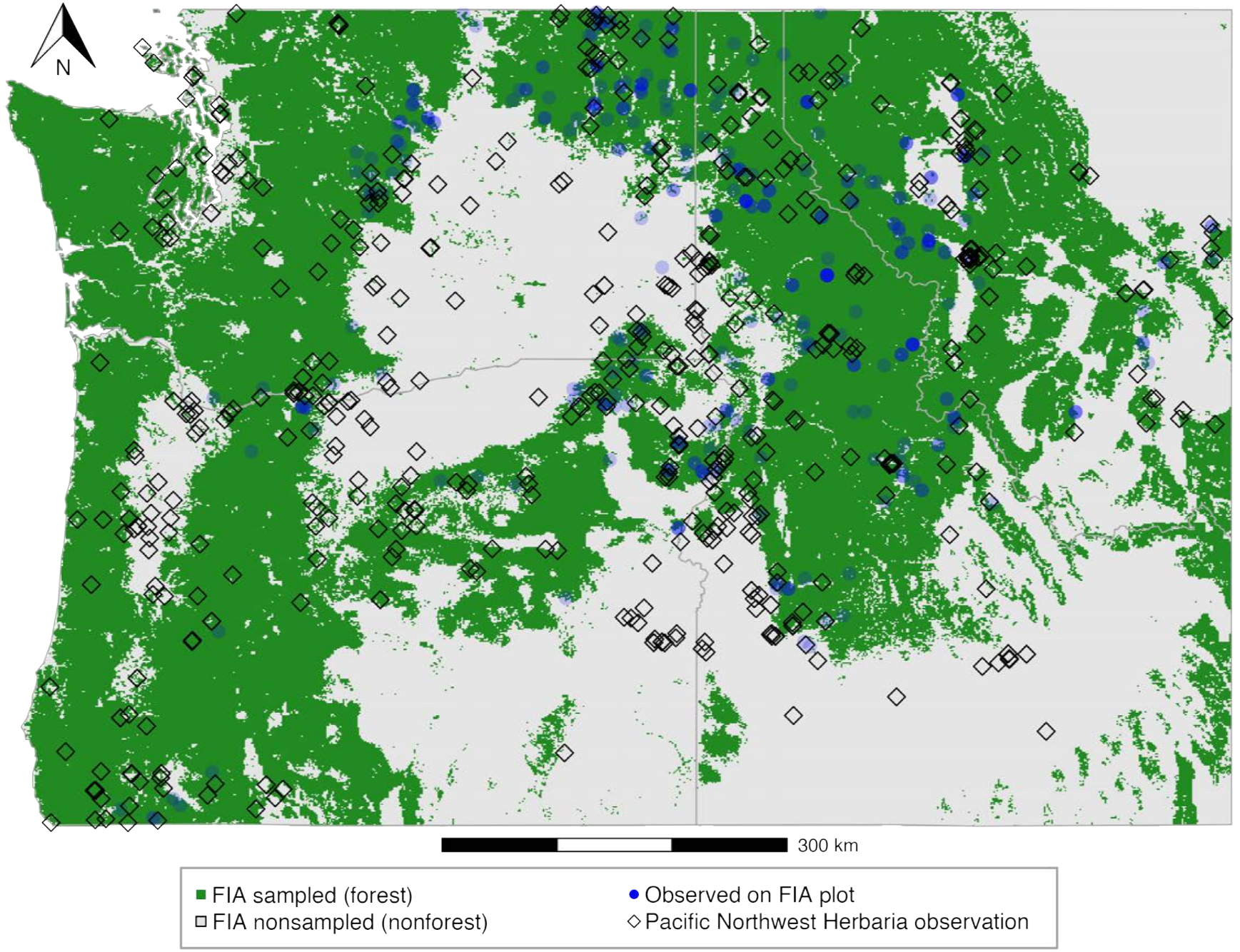
Oregon boxleaf, mountain boxwood (n = 1436)

Paxistima myrsinites



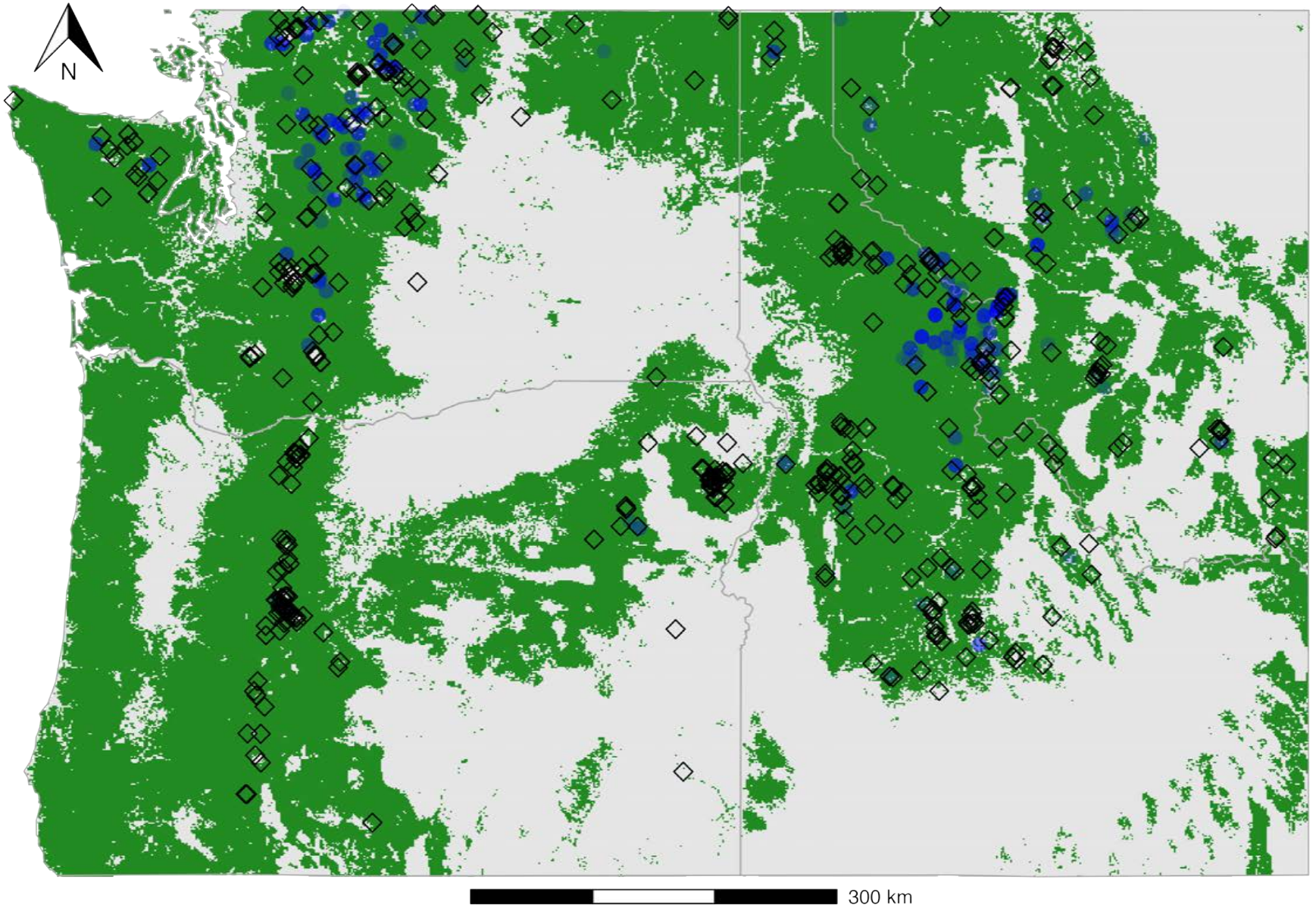
Lewis' mock orange, mock–orange (n = 804)

Philadelphus lewisii



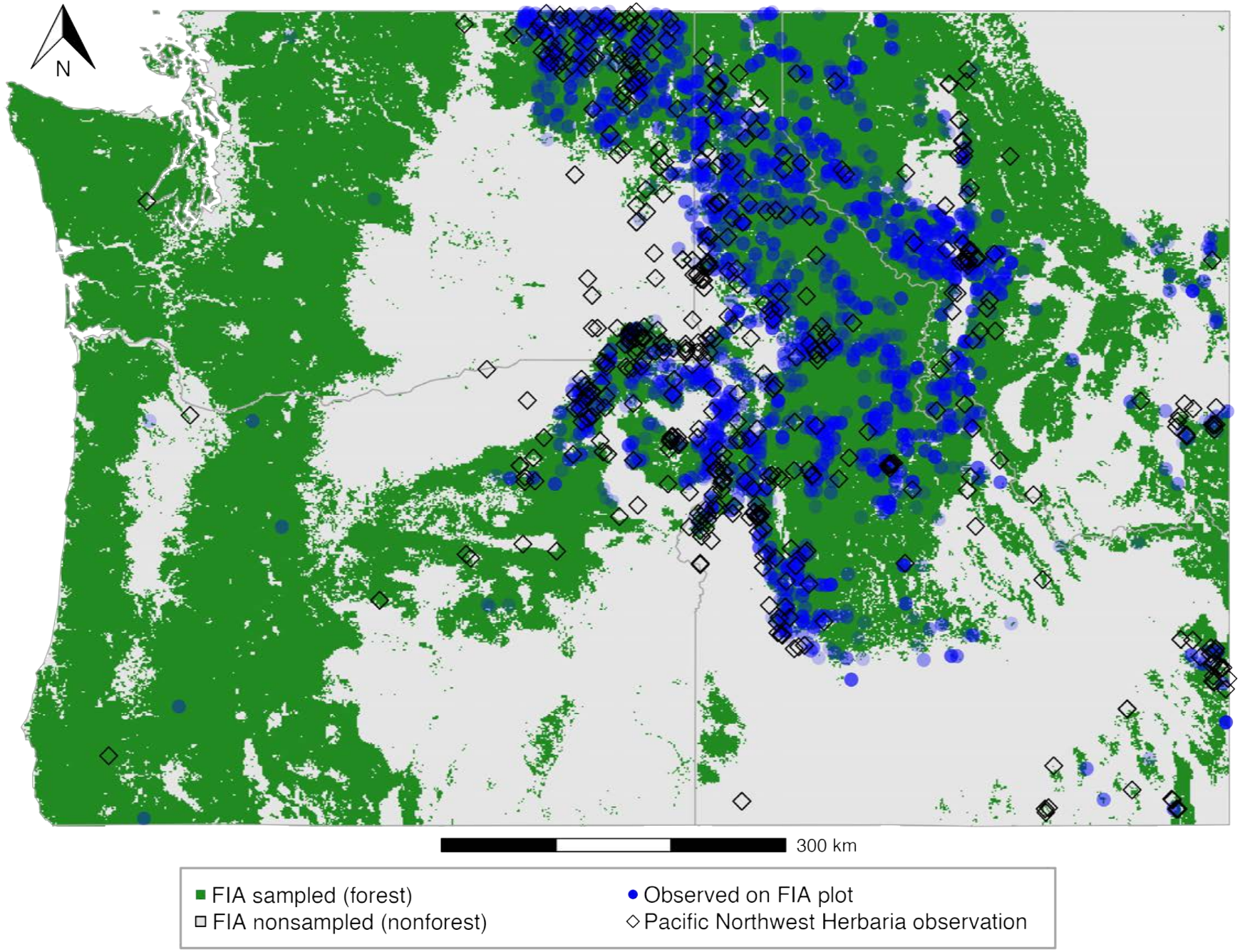
pink mountainheath, pink mountain–heather (n = 727)

Phyllodoce empetriformis



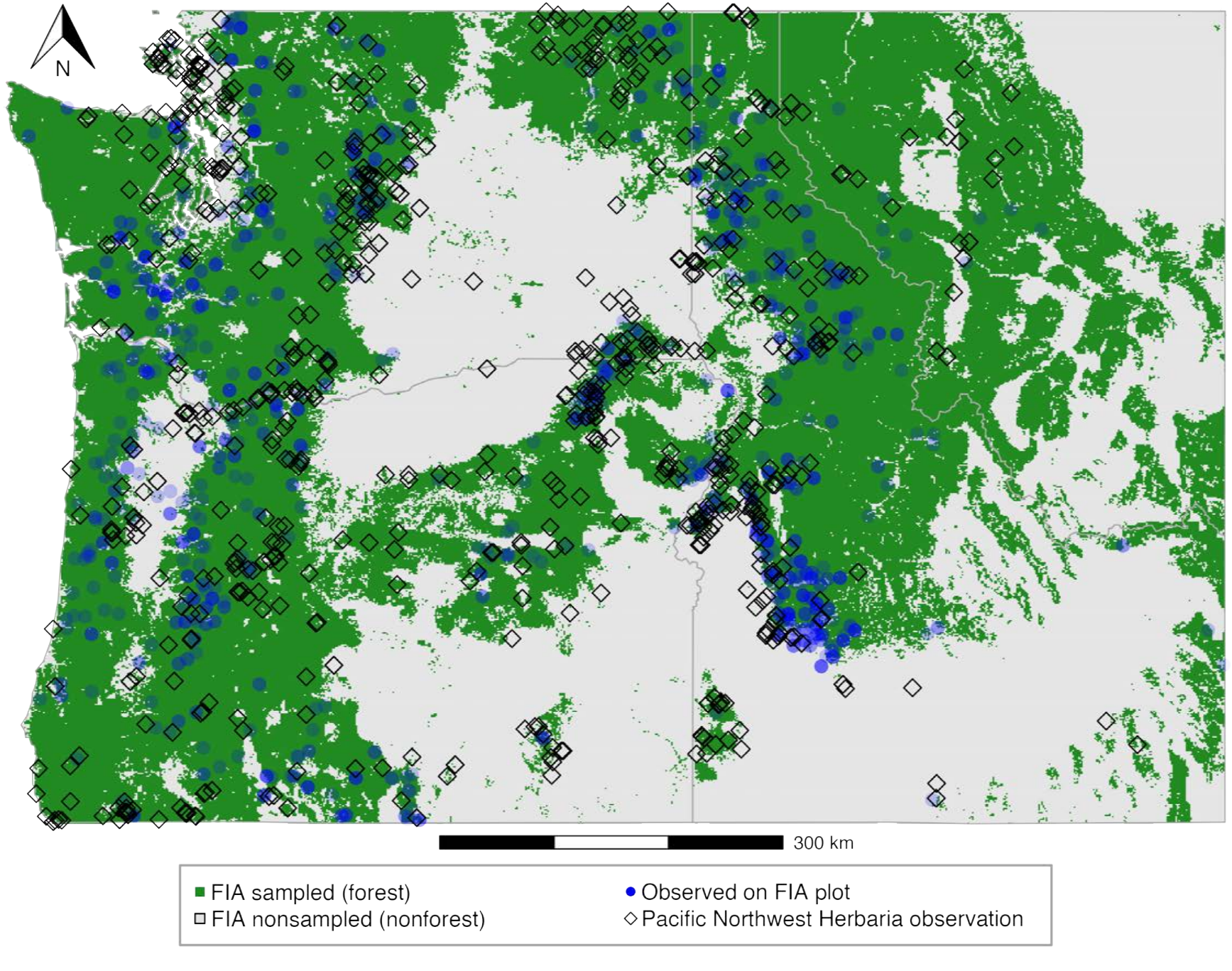
mallow ninebark, Pacific ninebark (n = 1898)

Physocarpus malvaceus

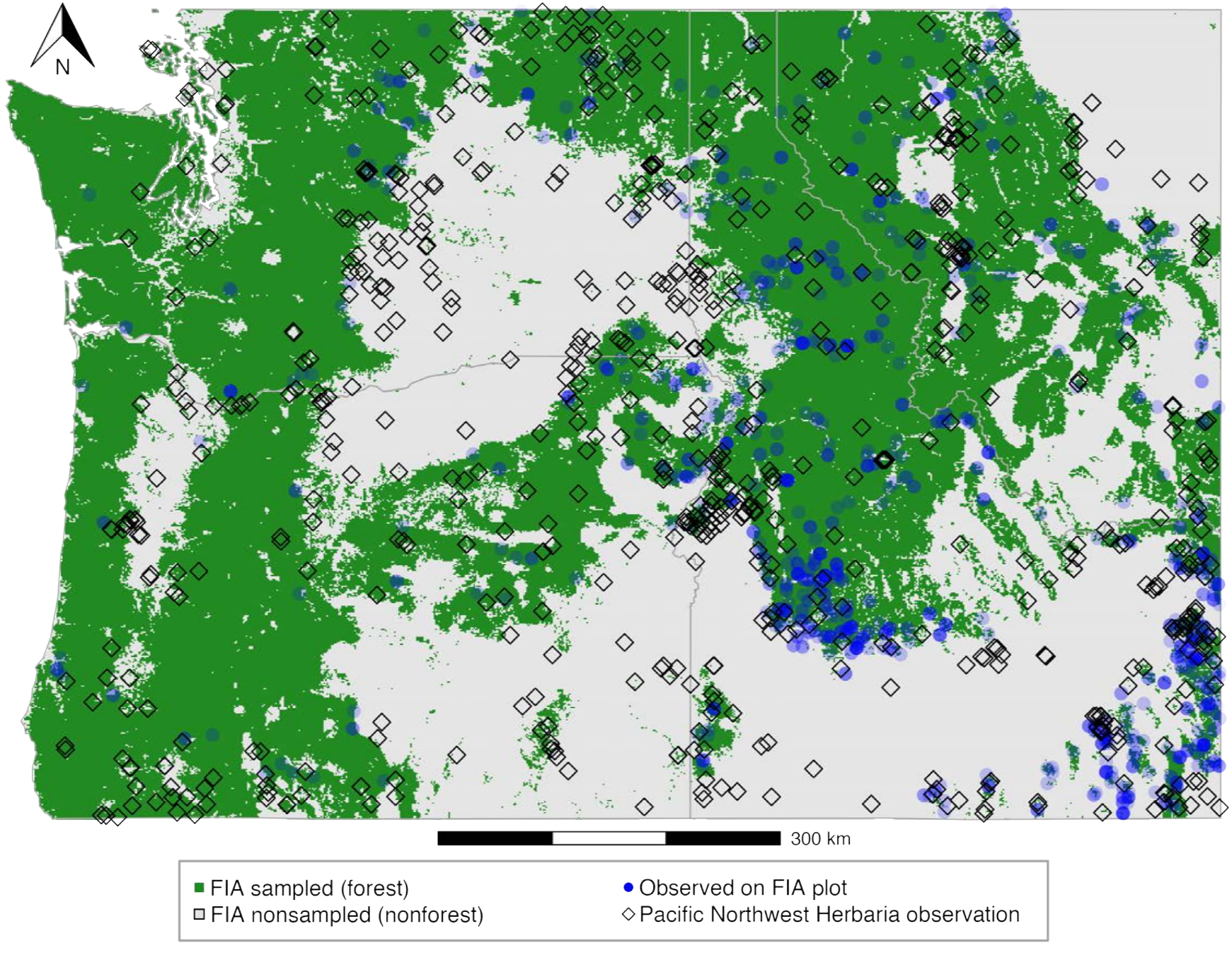


bitter cherry (n = 1408)

Prunus emarginata

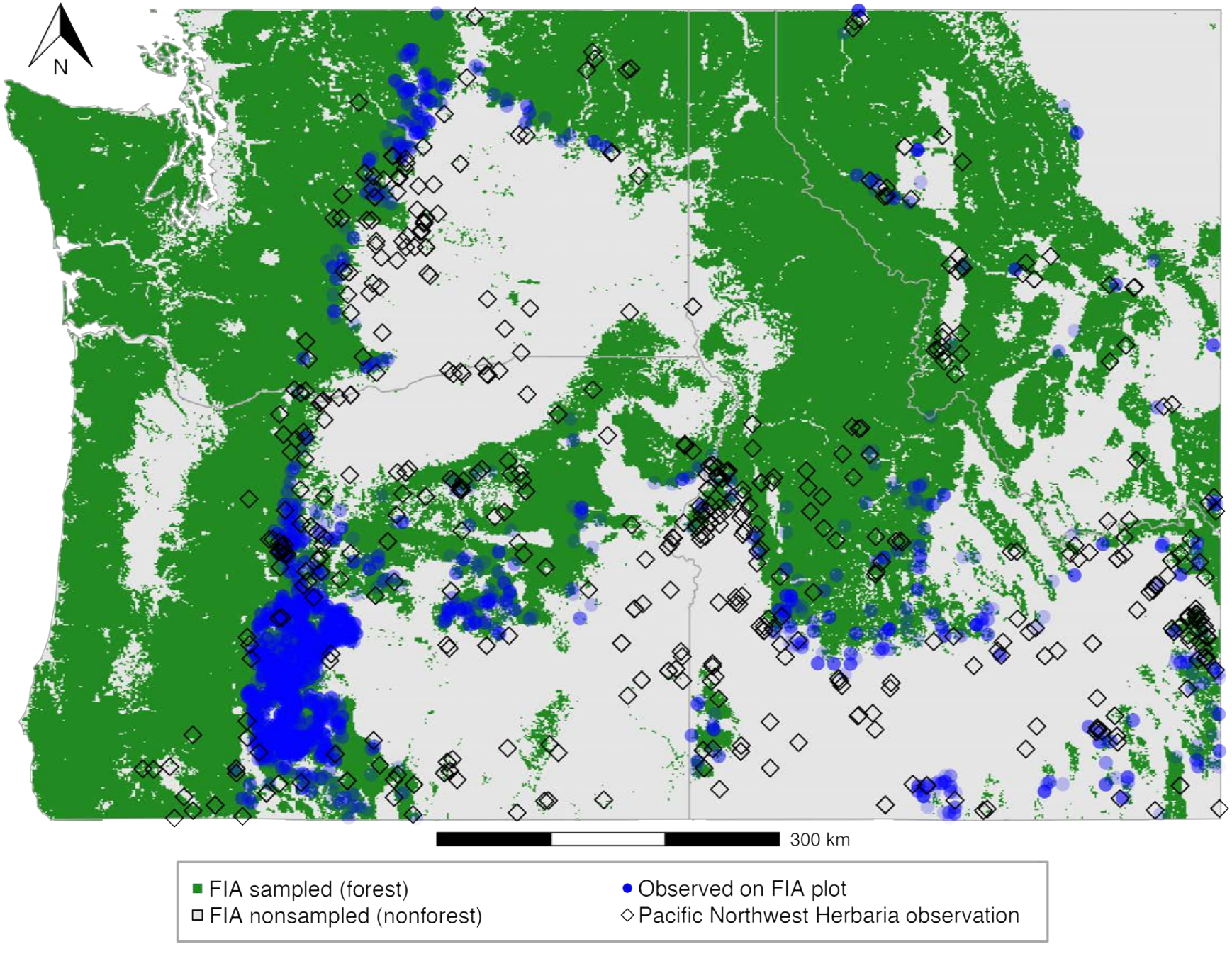


chokecherry (n = 1344)
Prunus virginiana

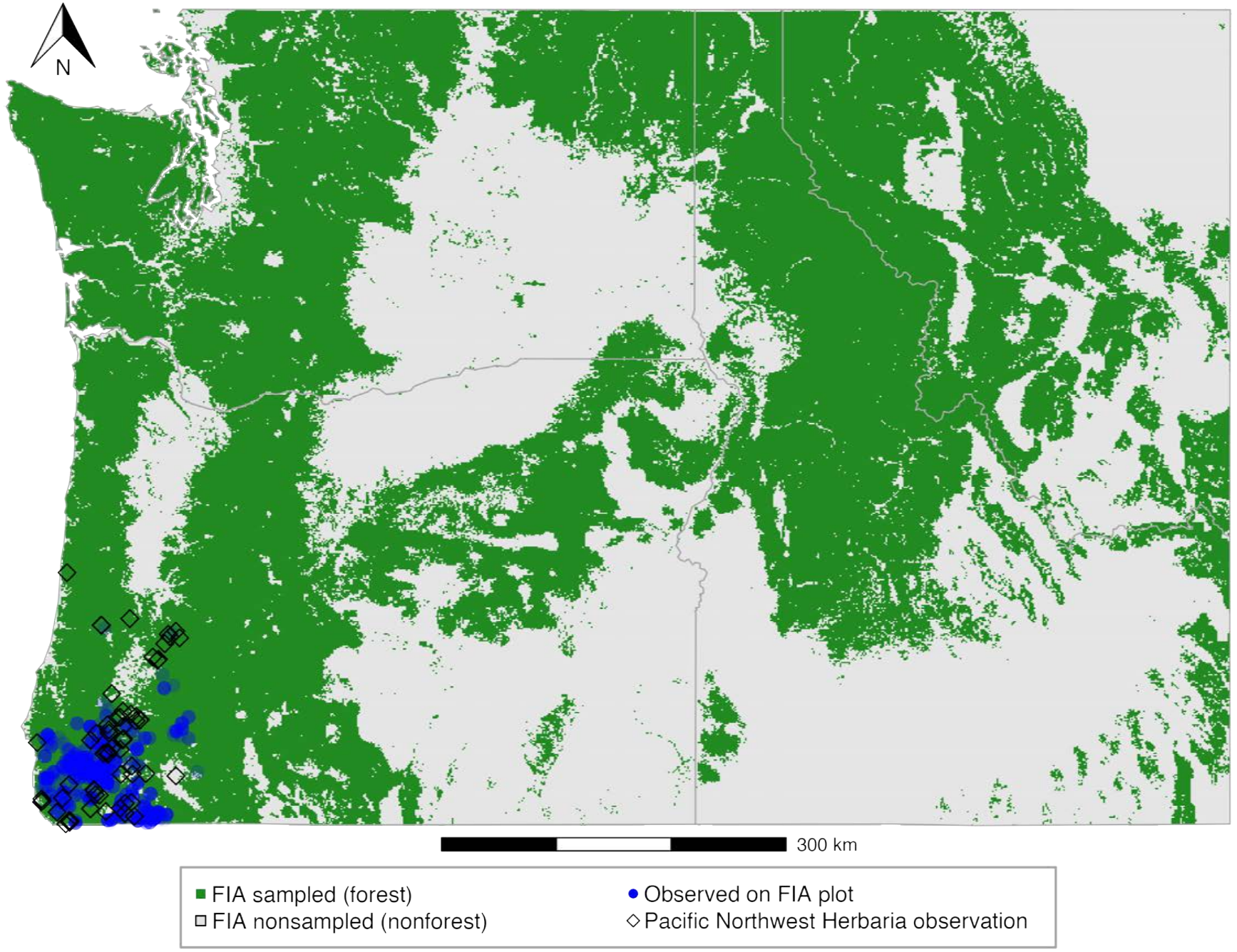


antelope bitterbrush (n = 1559)

Purshia tridentata

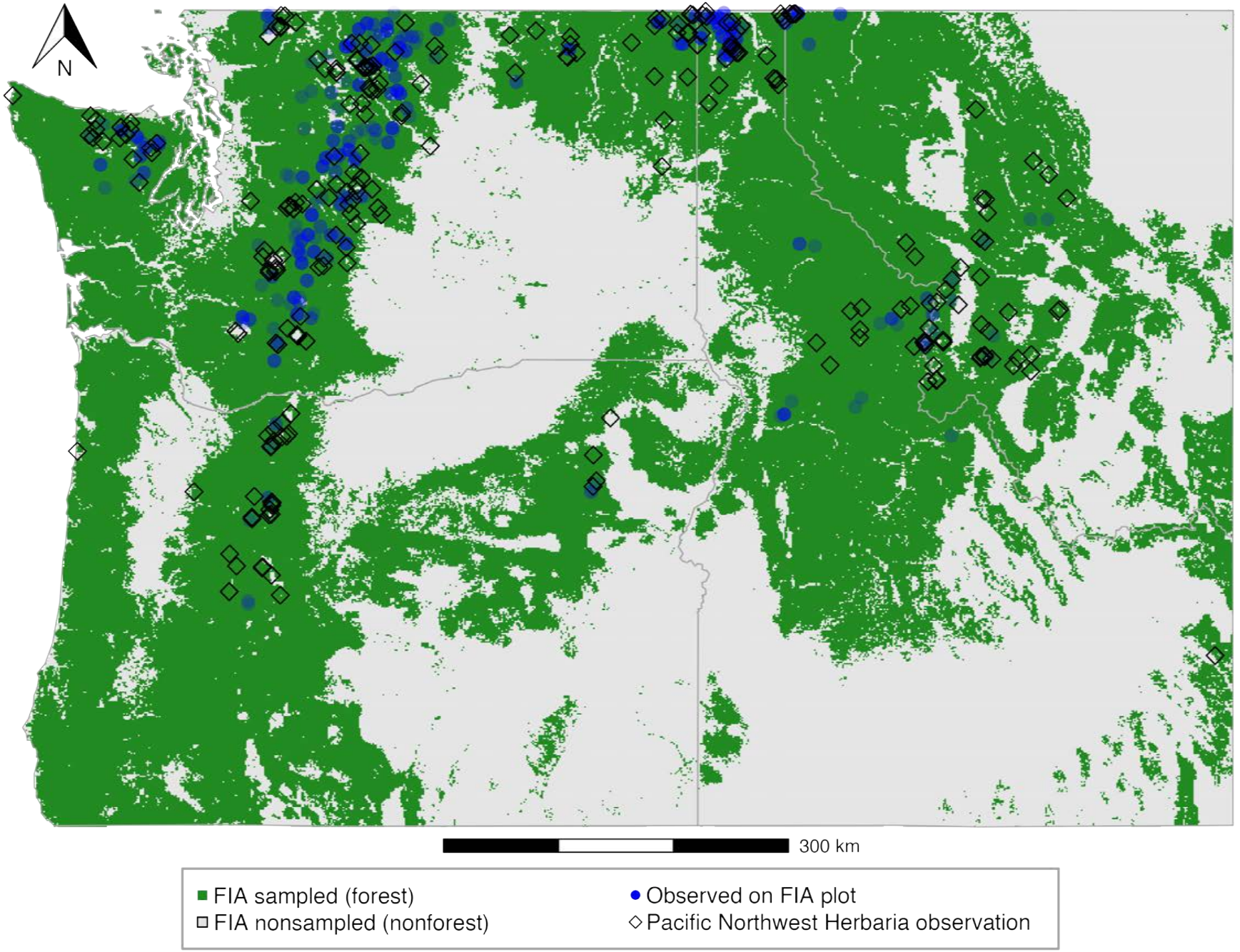


canyon live oak (n = 256)
Quercus chrysolepis

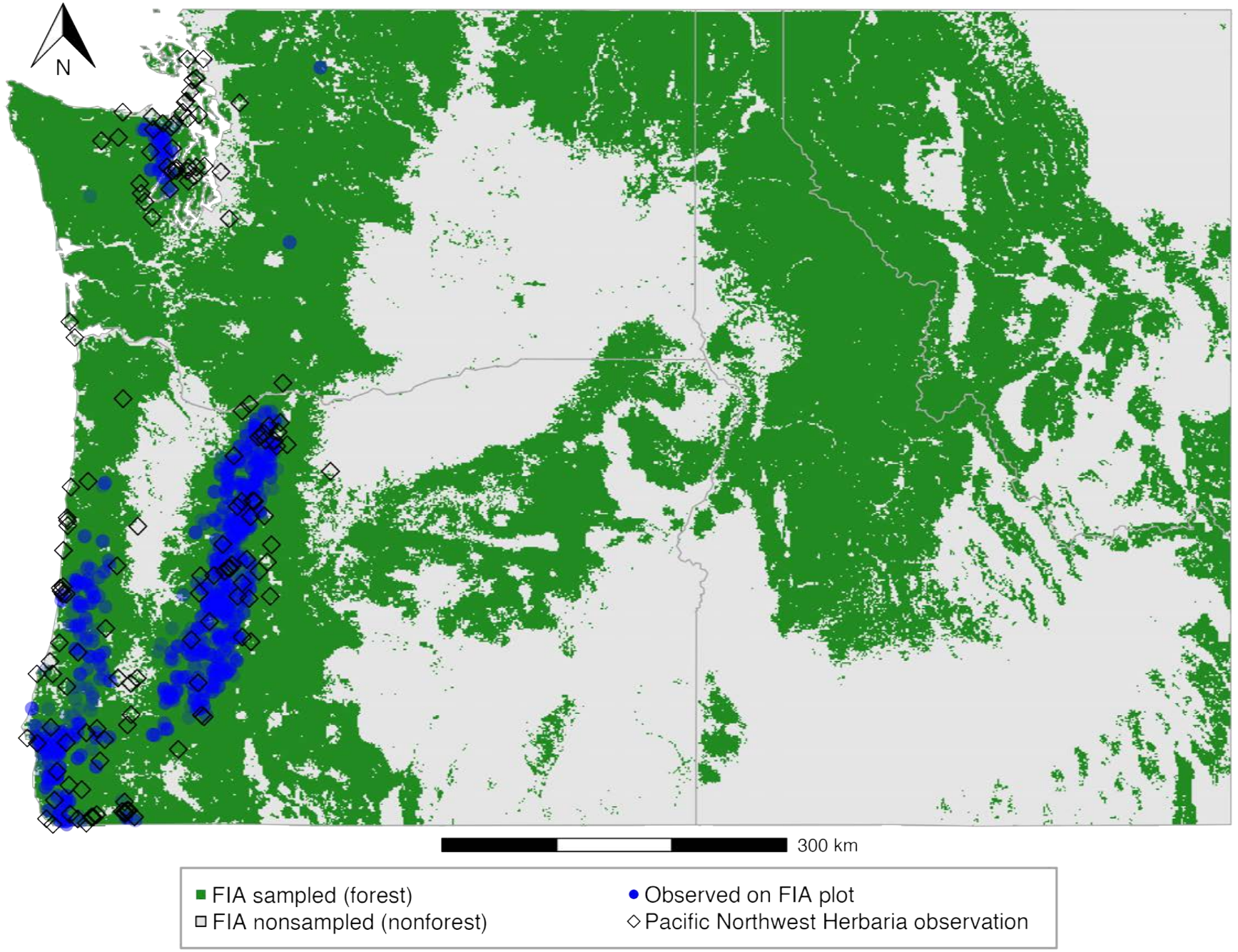


Cascade azalea, white–flowered rhododendron (n = 509)

Rhododendron albiflorum

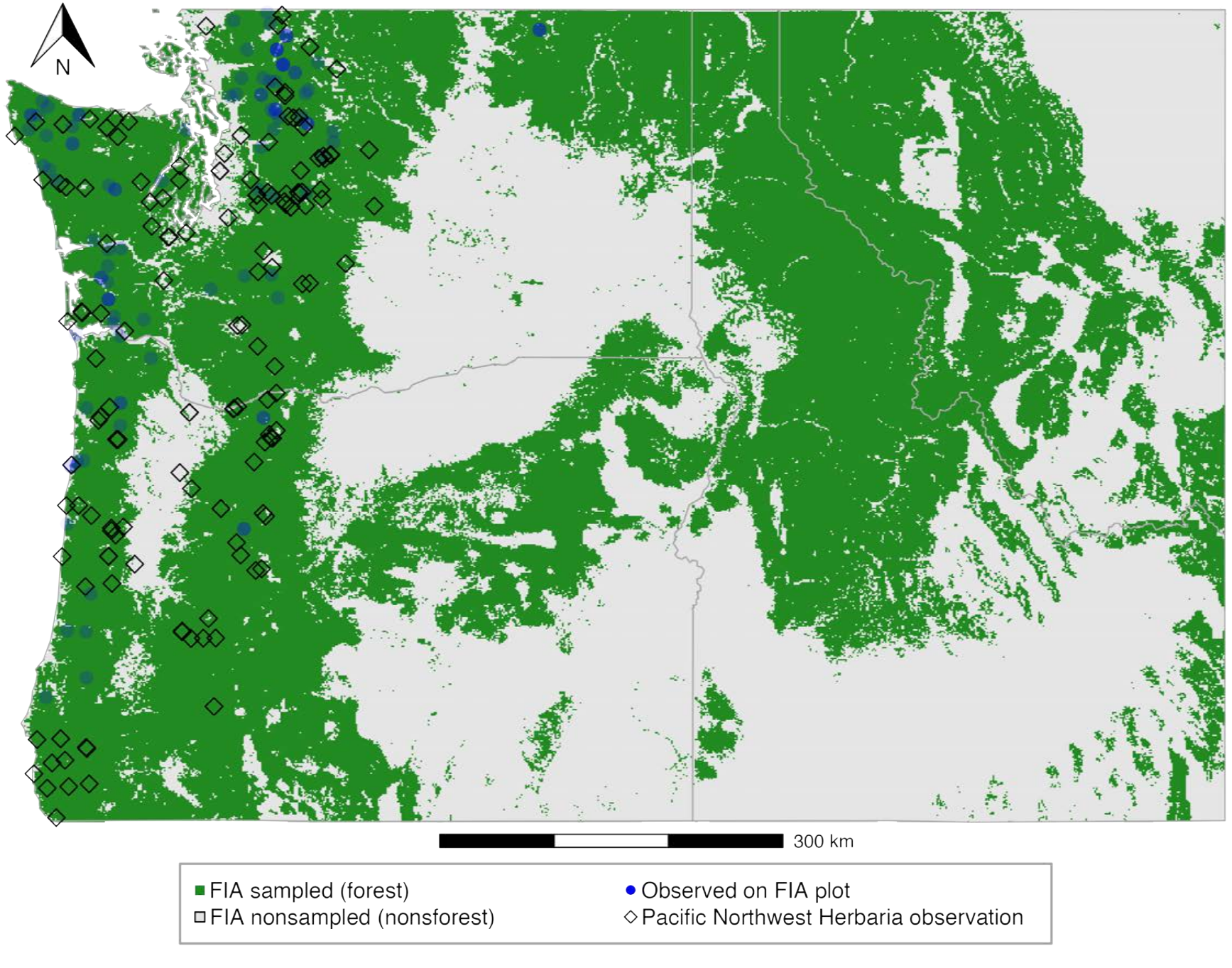


Pacific rhododendron (n = 764)
Rhododendron macrophyllum



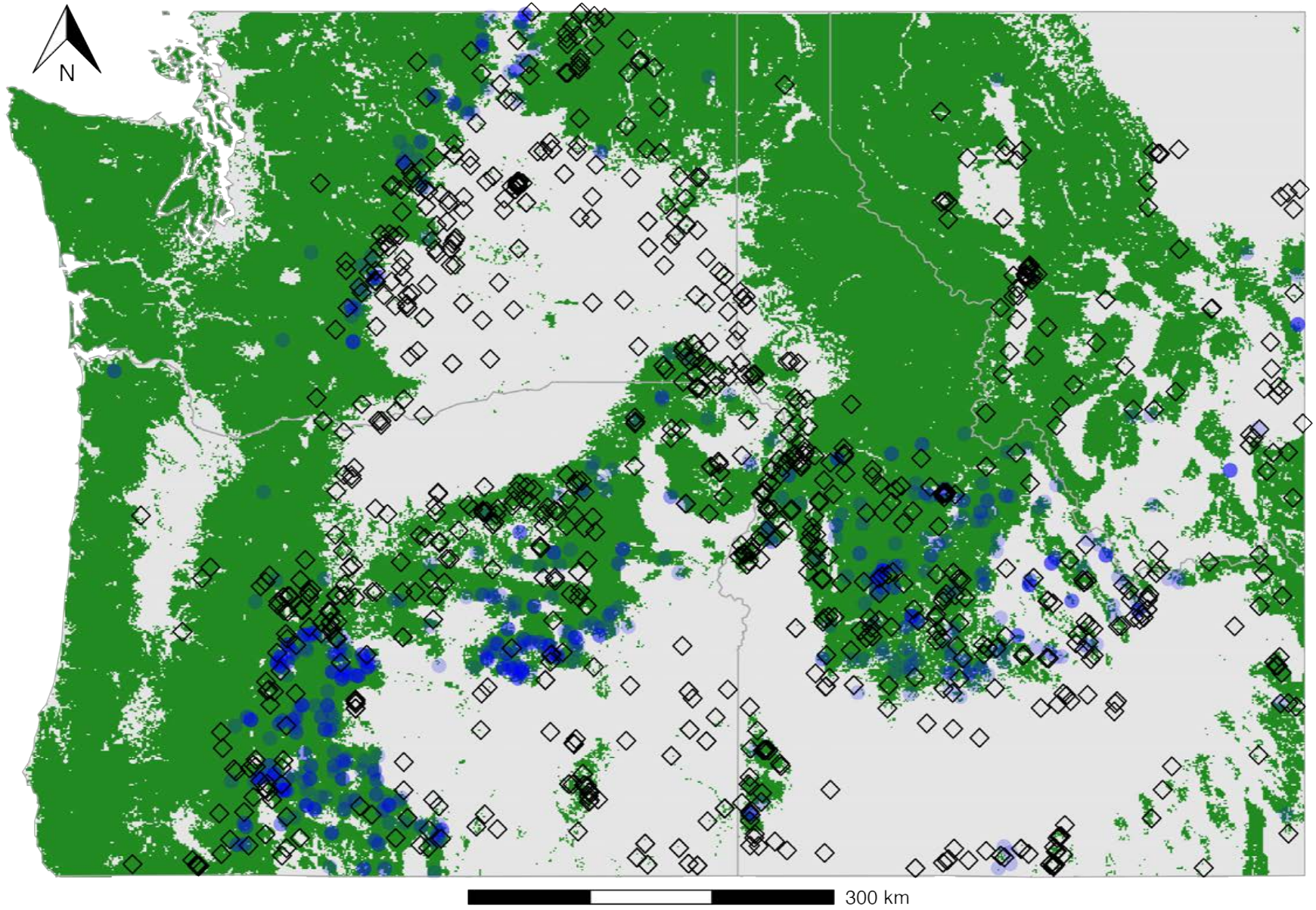
stink currant (n = 261)

Ribes bracteosum



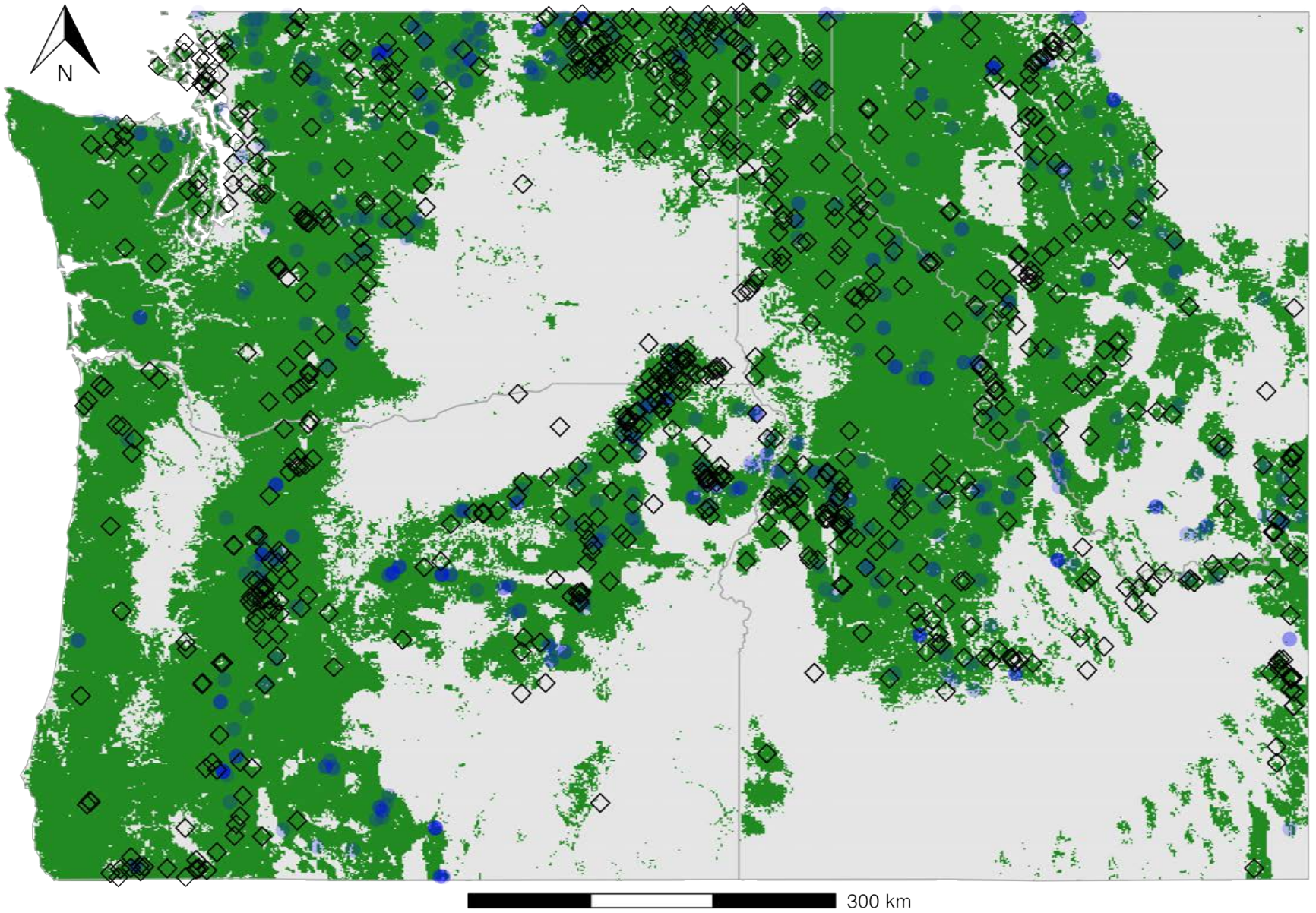
wax currant (n = 1461)

Ribes cereum

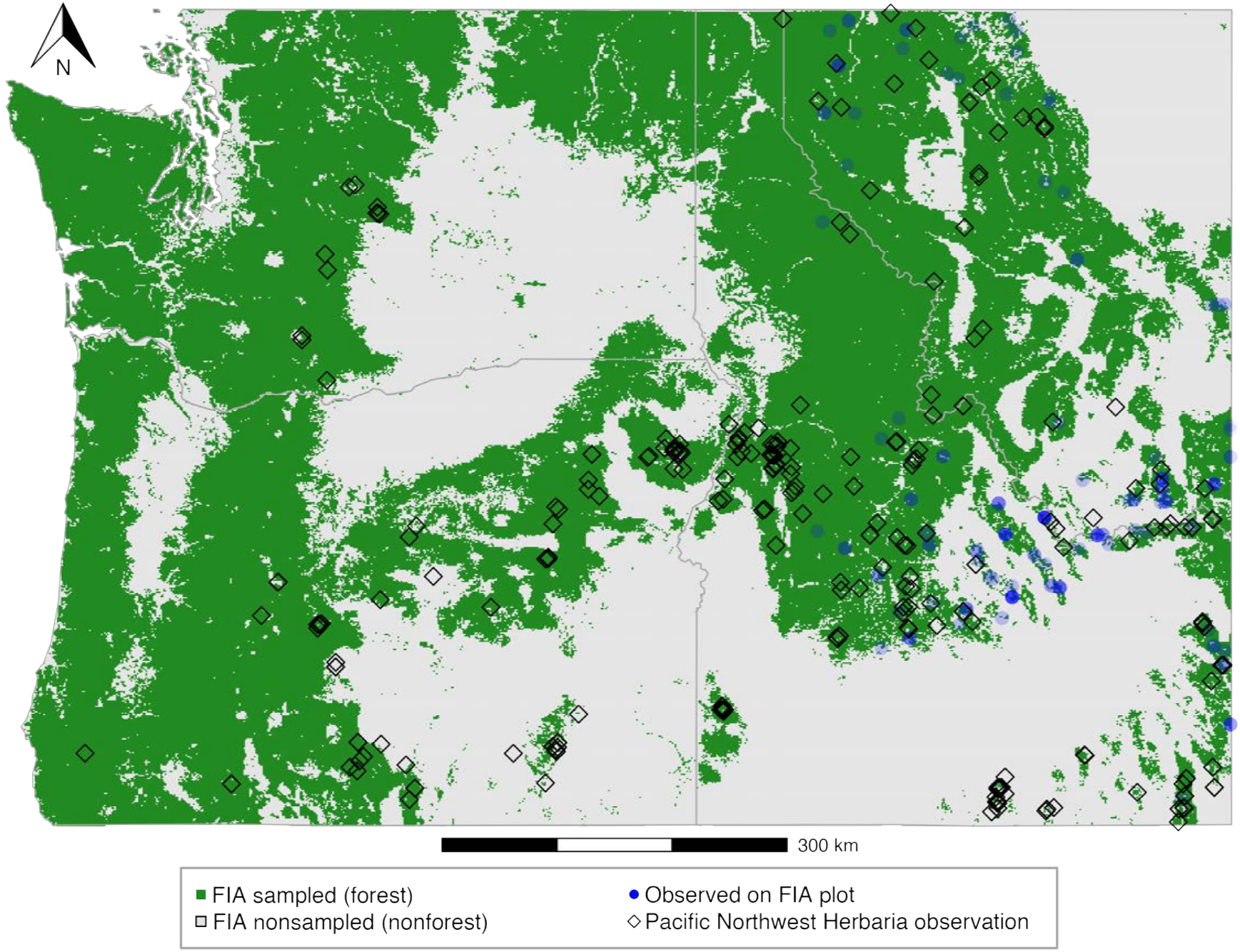


prickly currant, black gooseberry (n = 1205)

Ribes lacustre

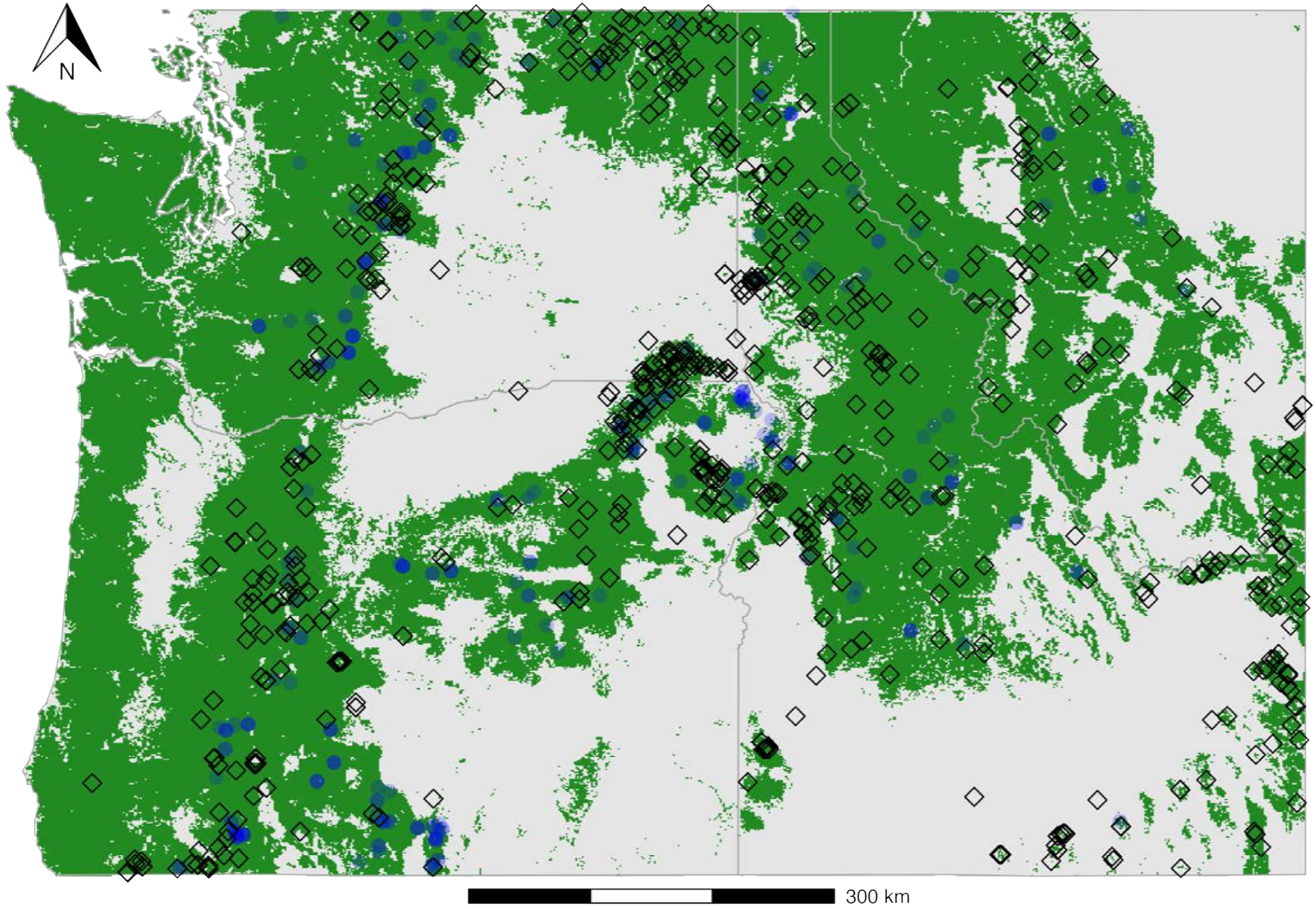


gooseberry currant (n = 363)
Ribes montigenum



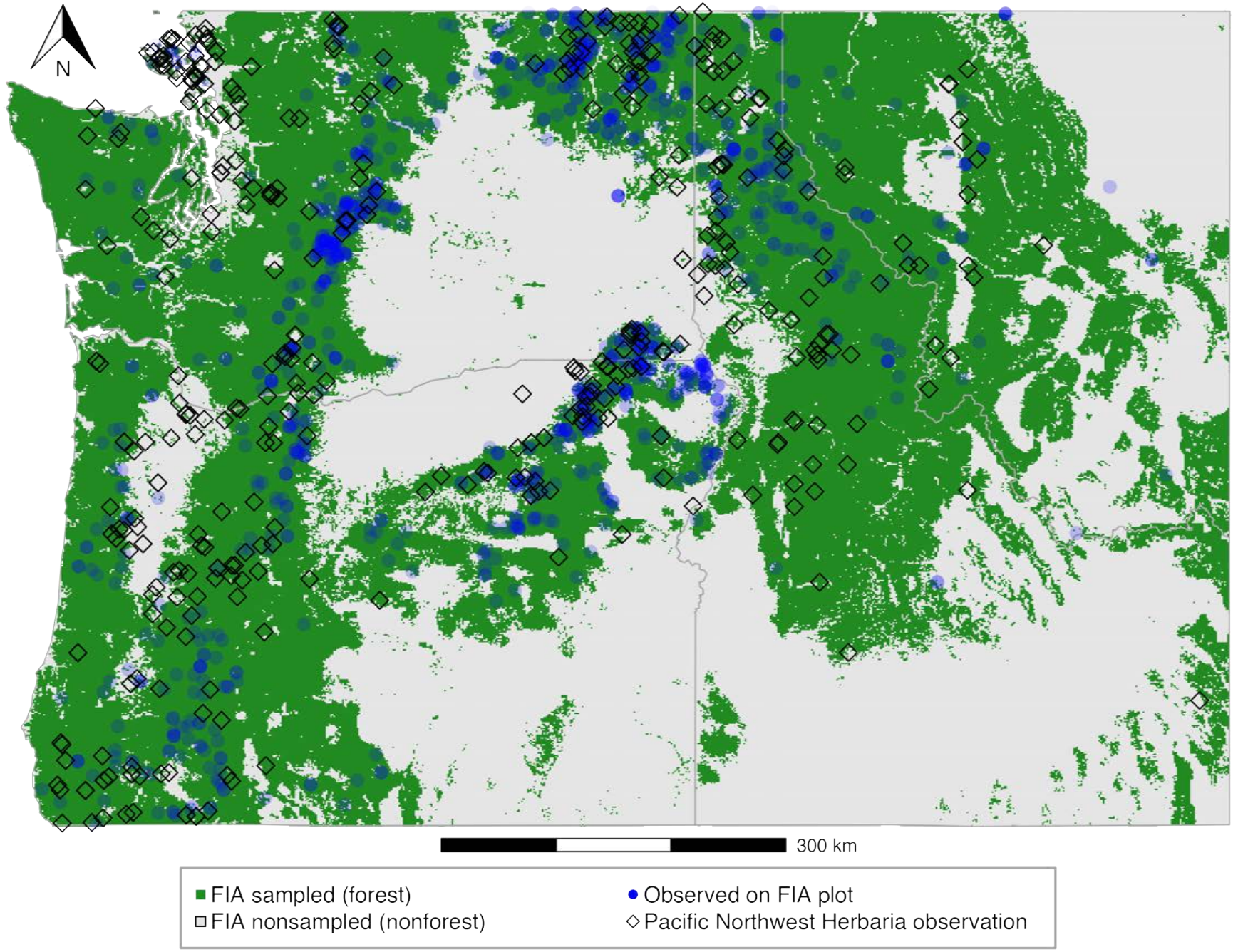
sticky currant (n = 894)

Ribes viscosissimum



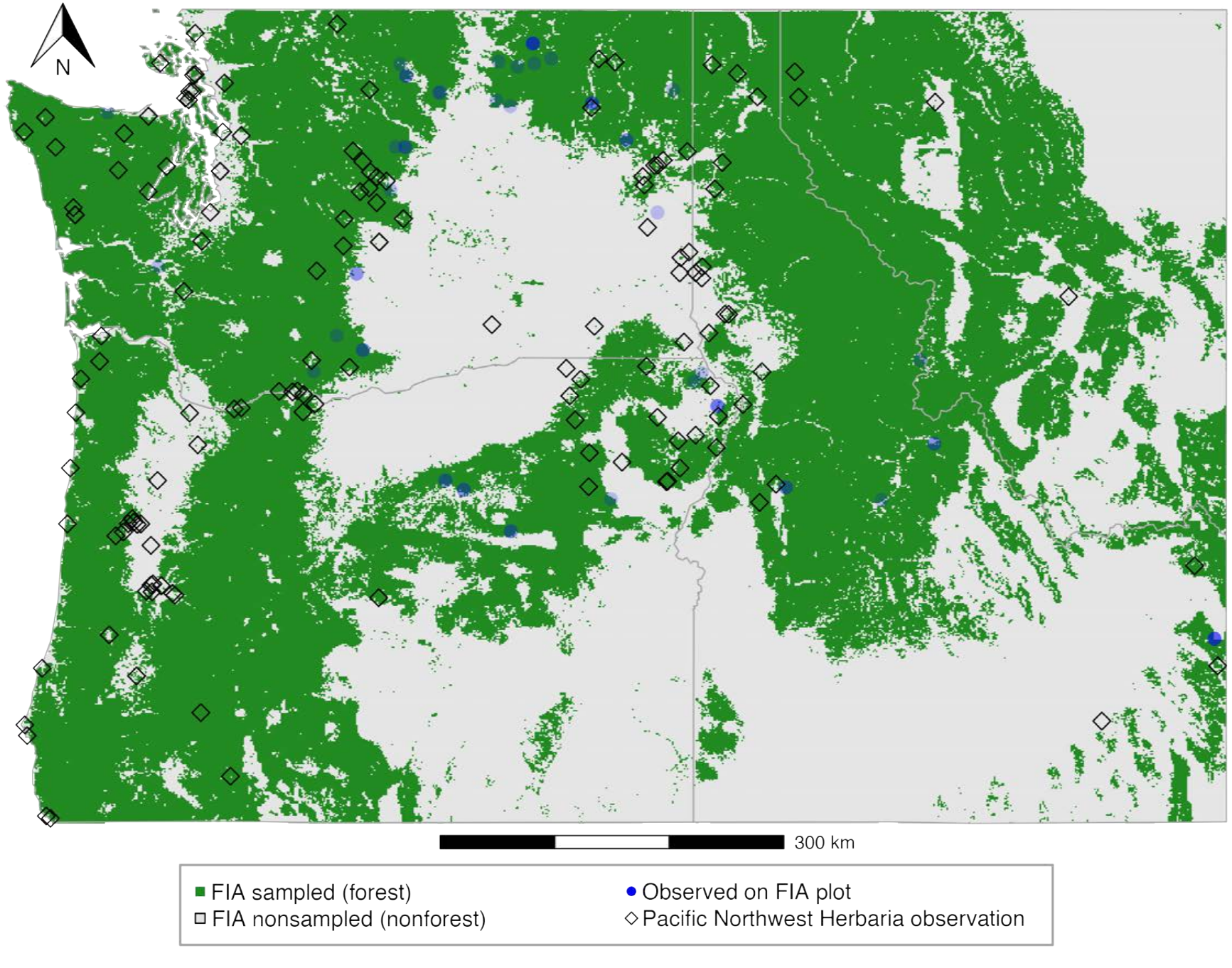
dwarf rose, baldhip rose (n = 1143)

Rosa gymnocarpa



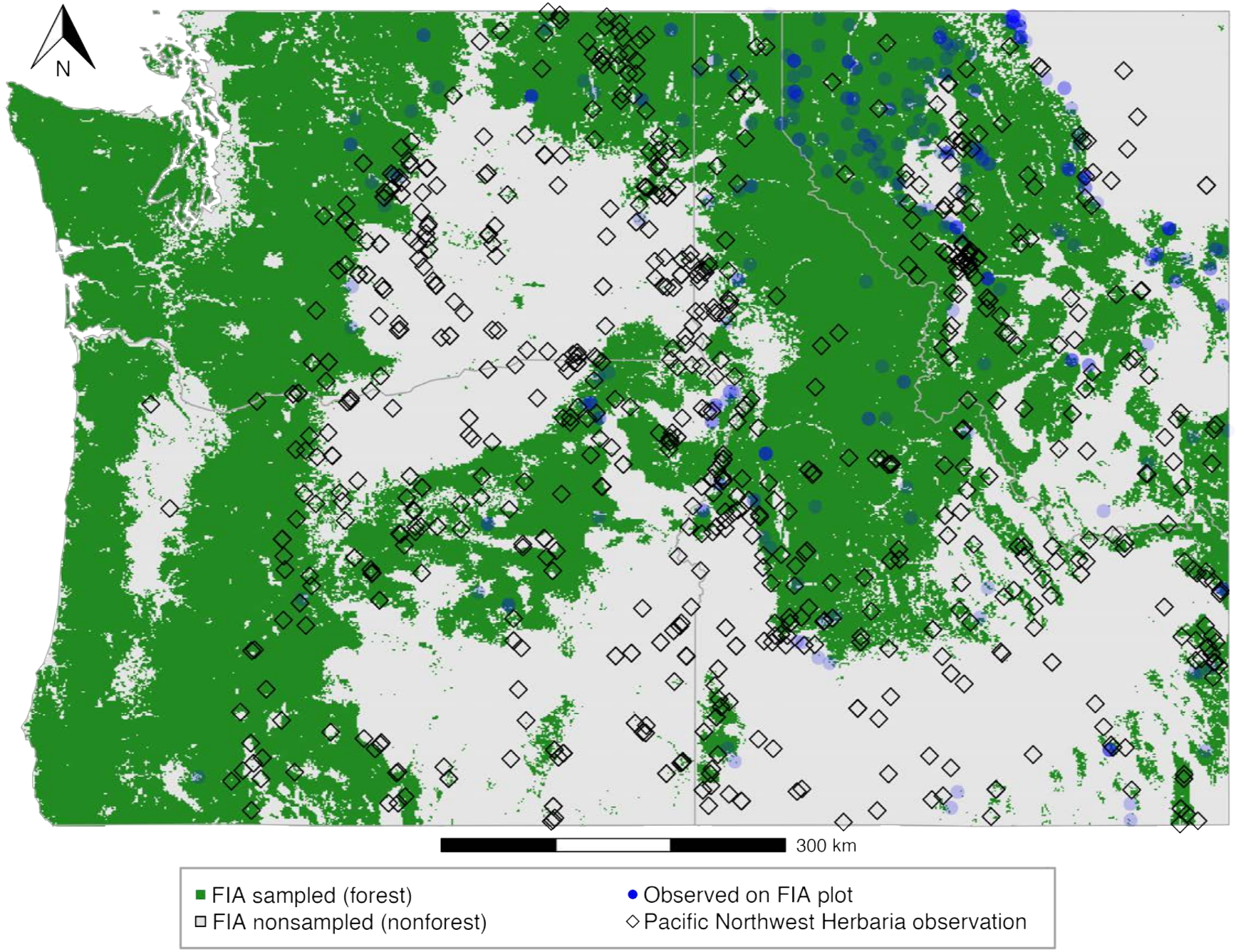
Nootka rose (n = 235)

Rosa nutkana



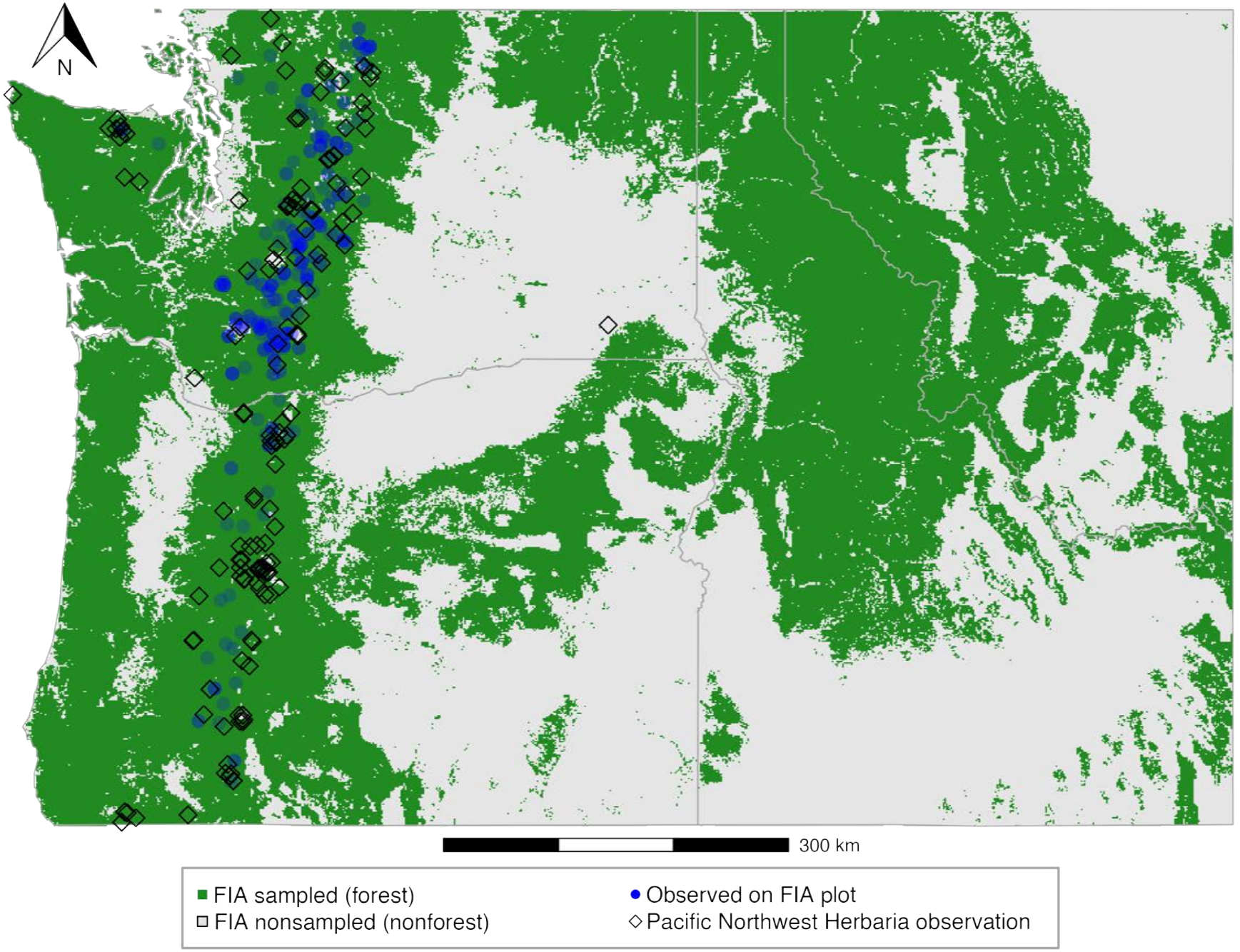
Woods' rose (n = 1133)

Rosa woodsii



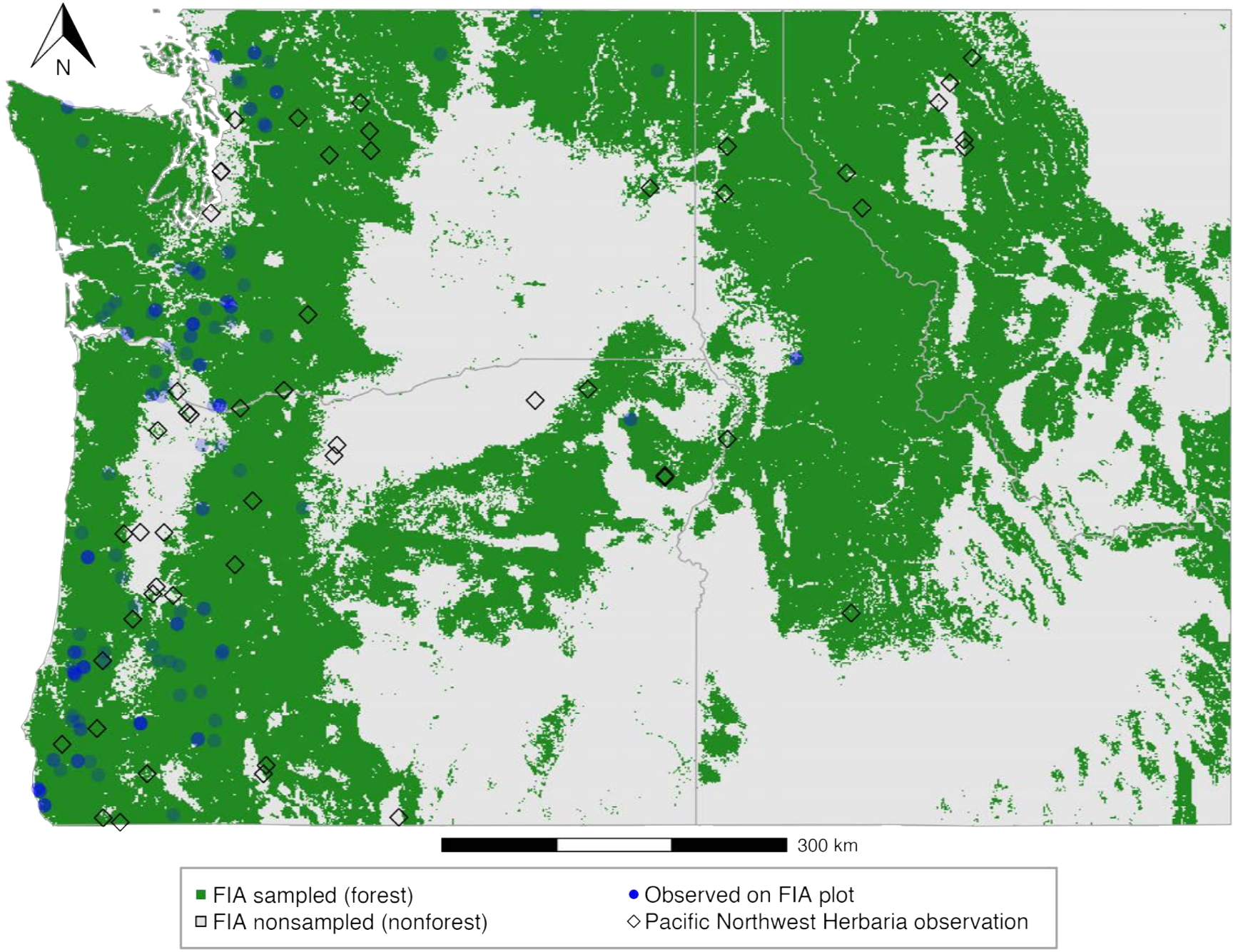
roughfruit berry, dwarf rable (n = 323)

Rubus lasiococcus



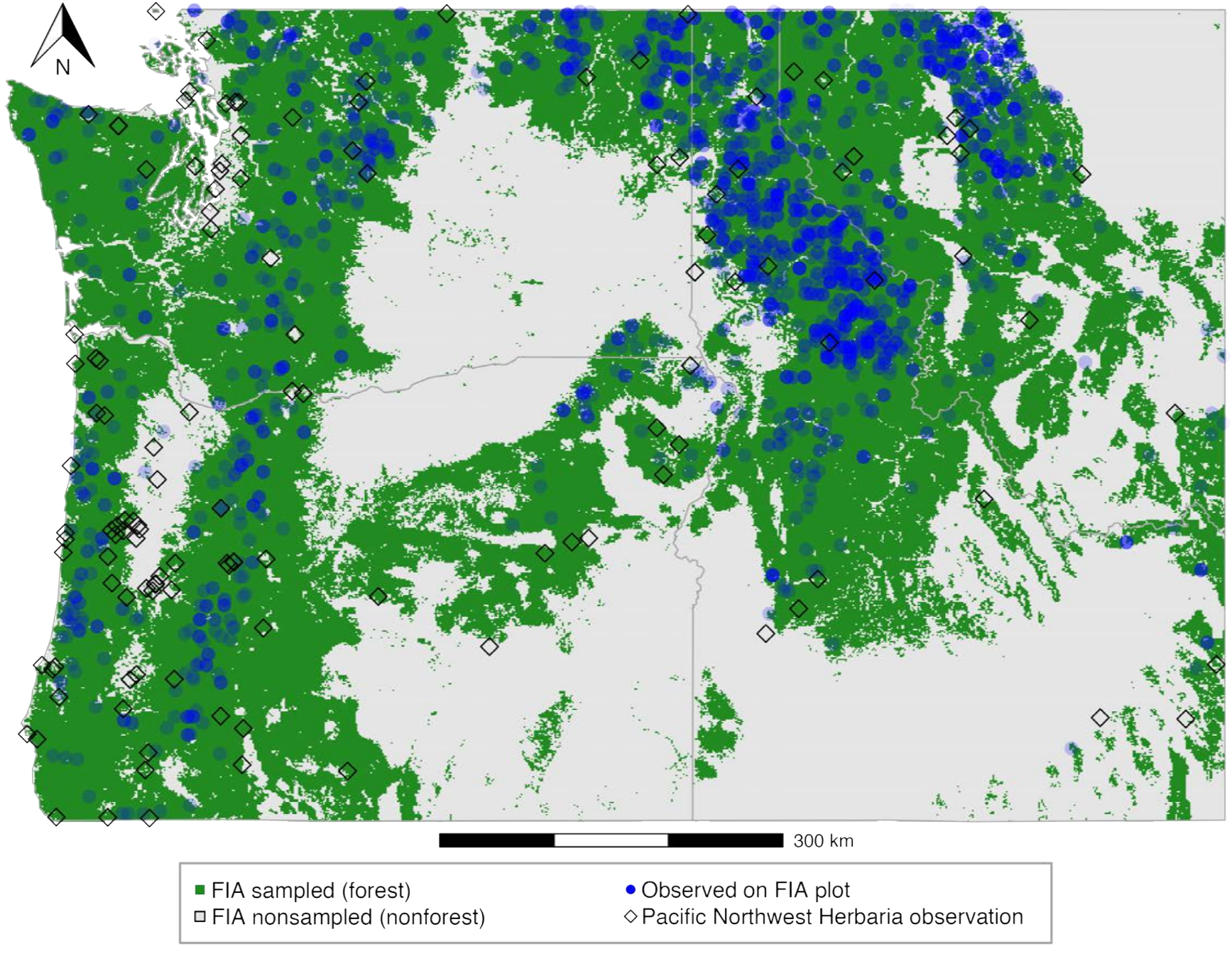
whitebark raspberry, blackcap (n = 148)

Rubus leucodermis



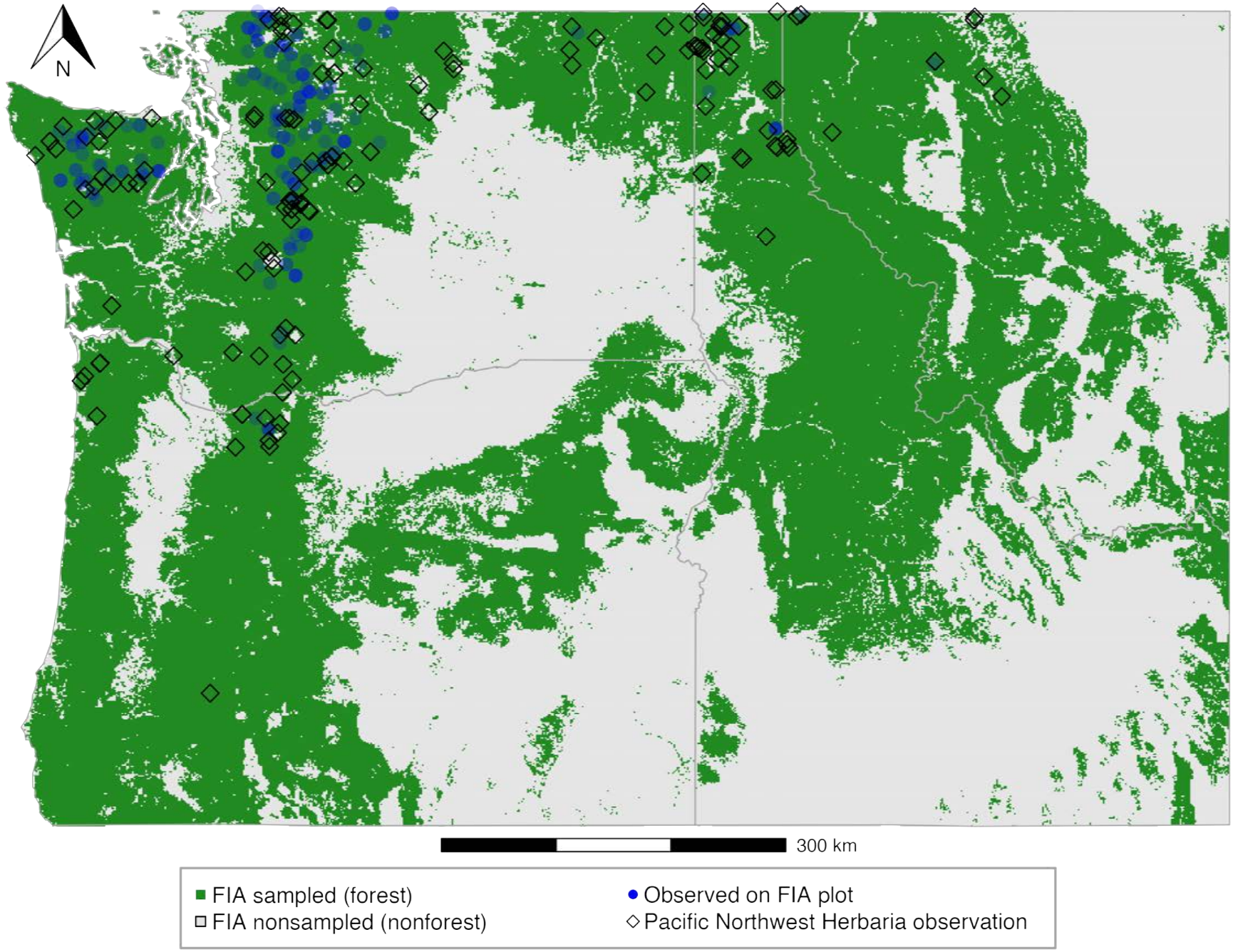
thimbleberry (n = 1170)

Rubus parviflorus

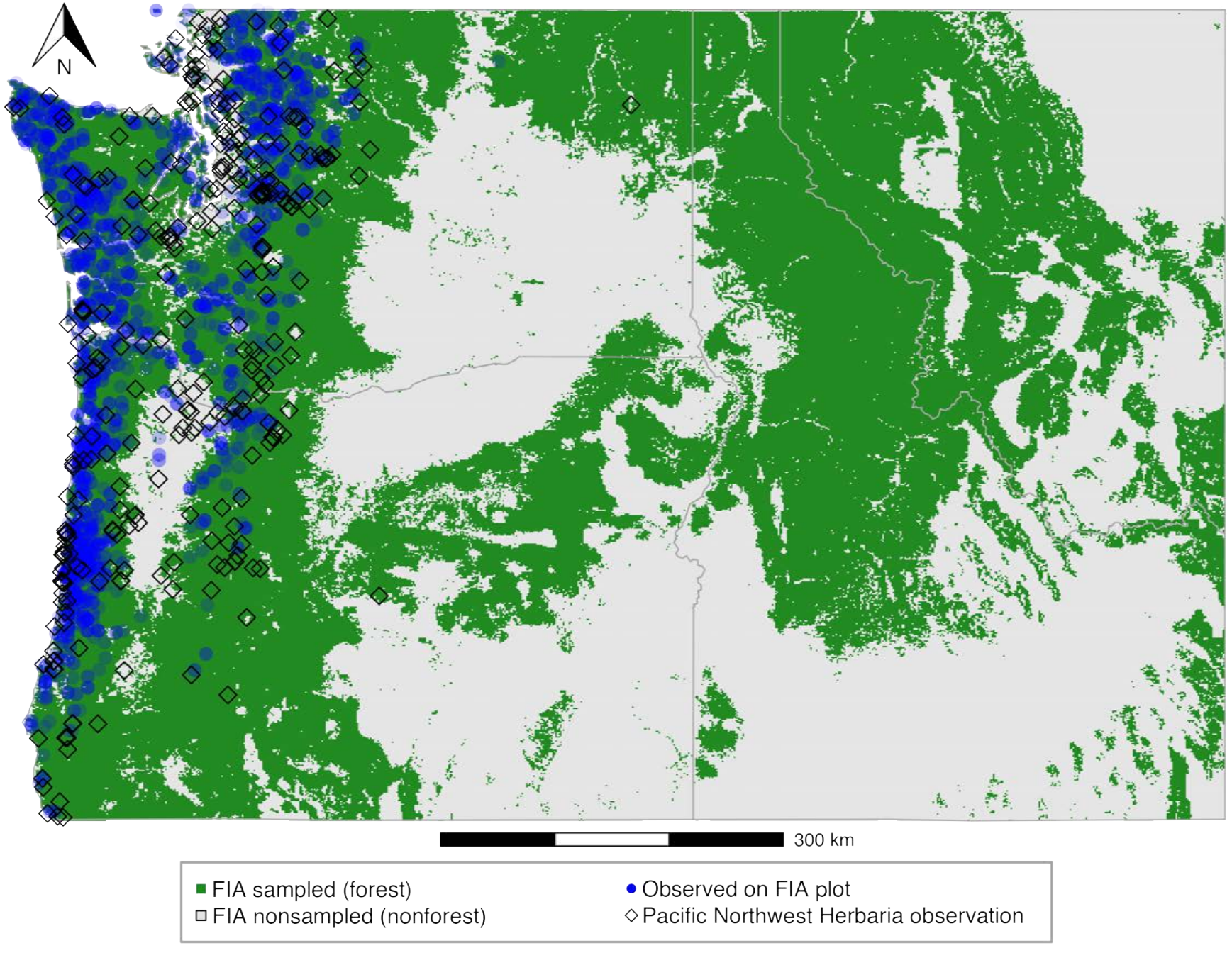


strawberryleaf raspberry (n = 284)

Rubus pedatus

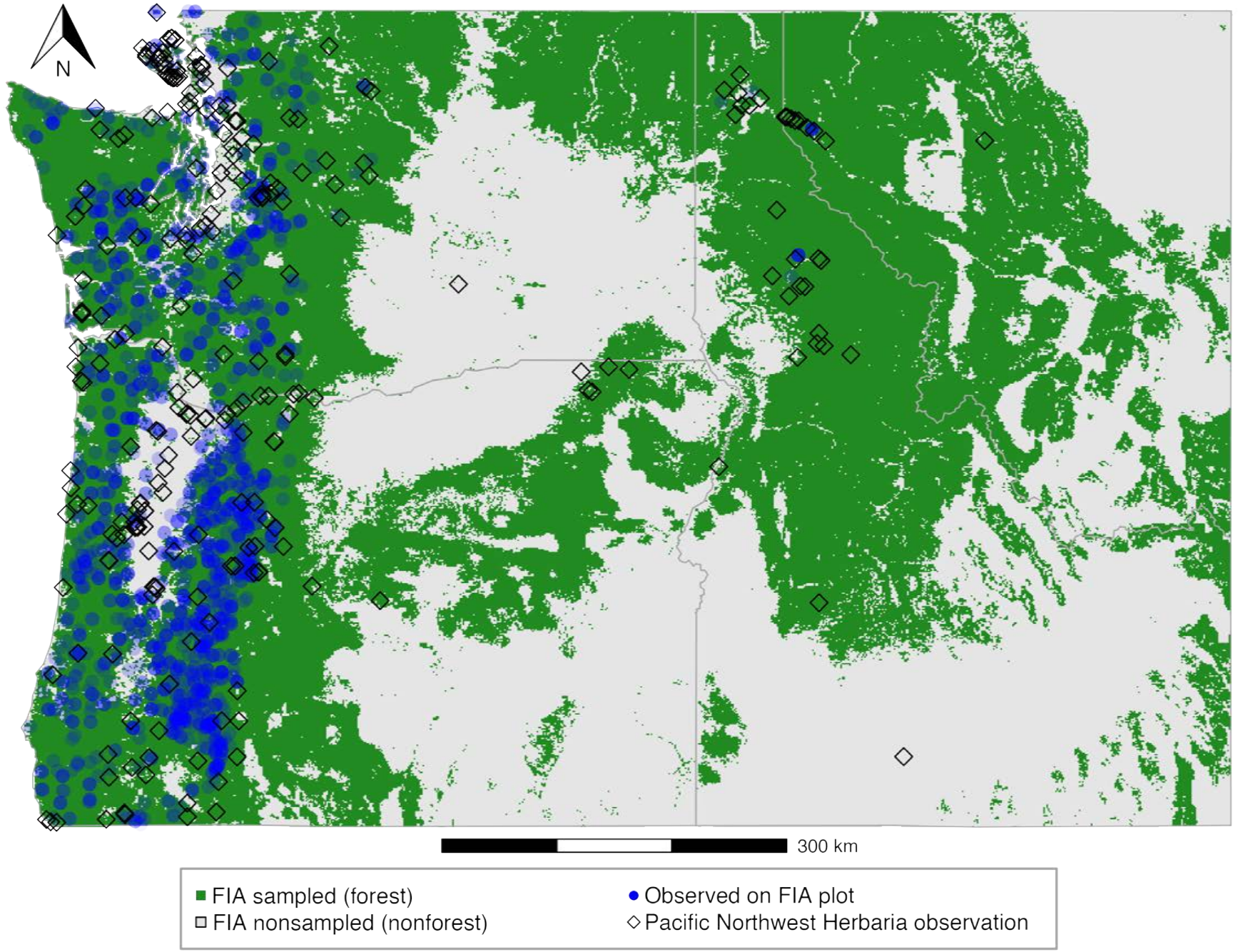


salmonberry (n = 1311)
Rubus spectabilis



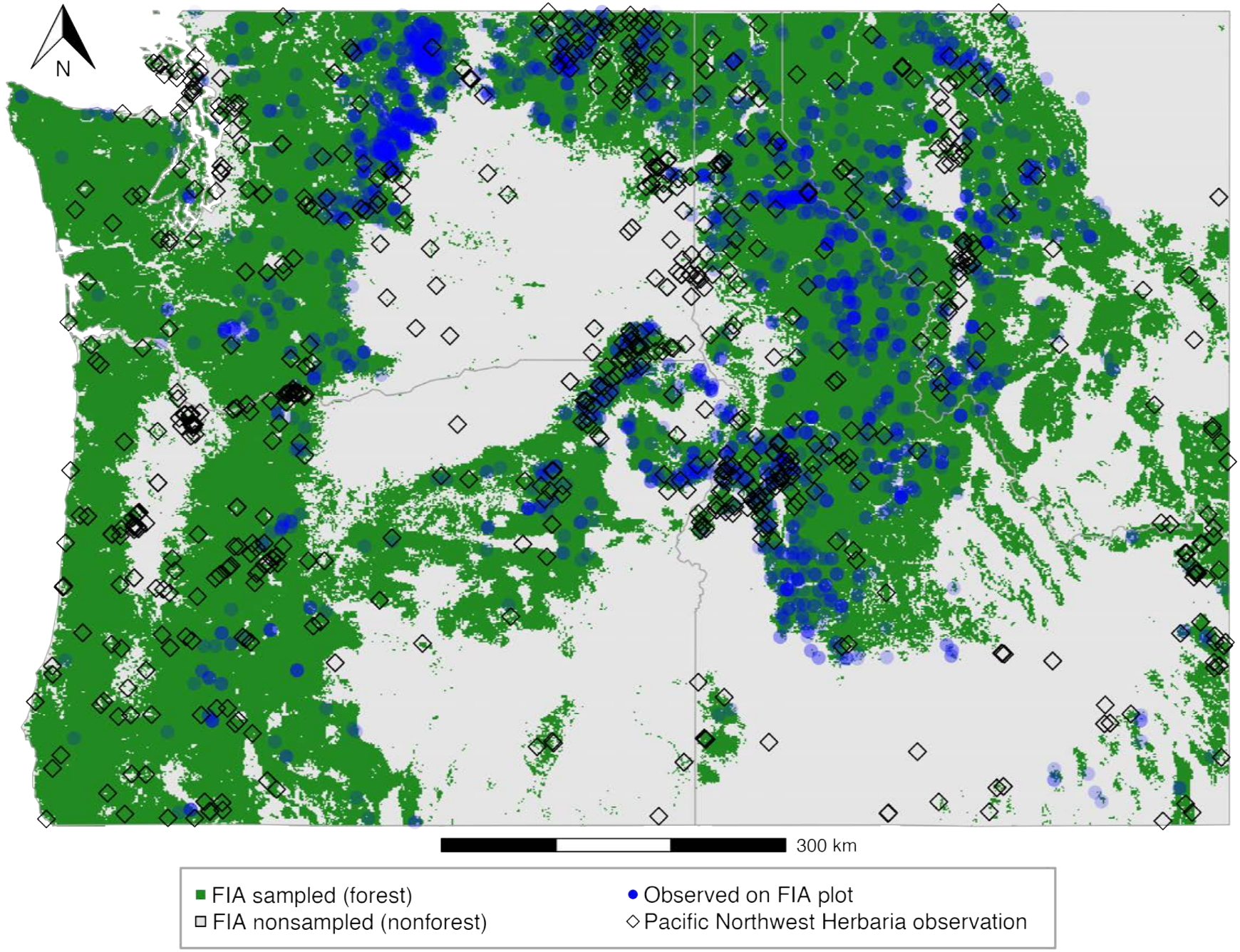
California blackberry, trailing blackberry (n = 1183)

Rubus ursinus



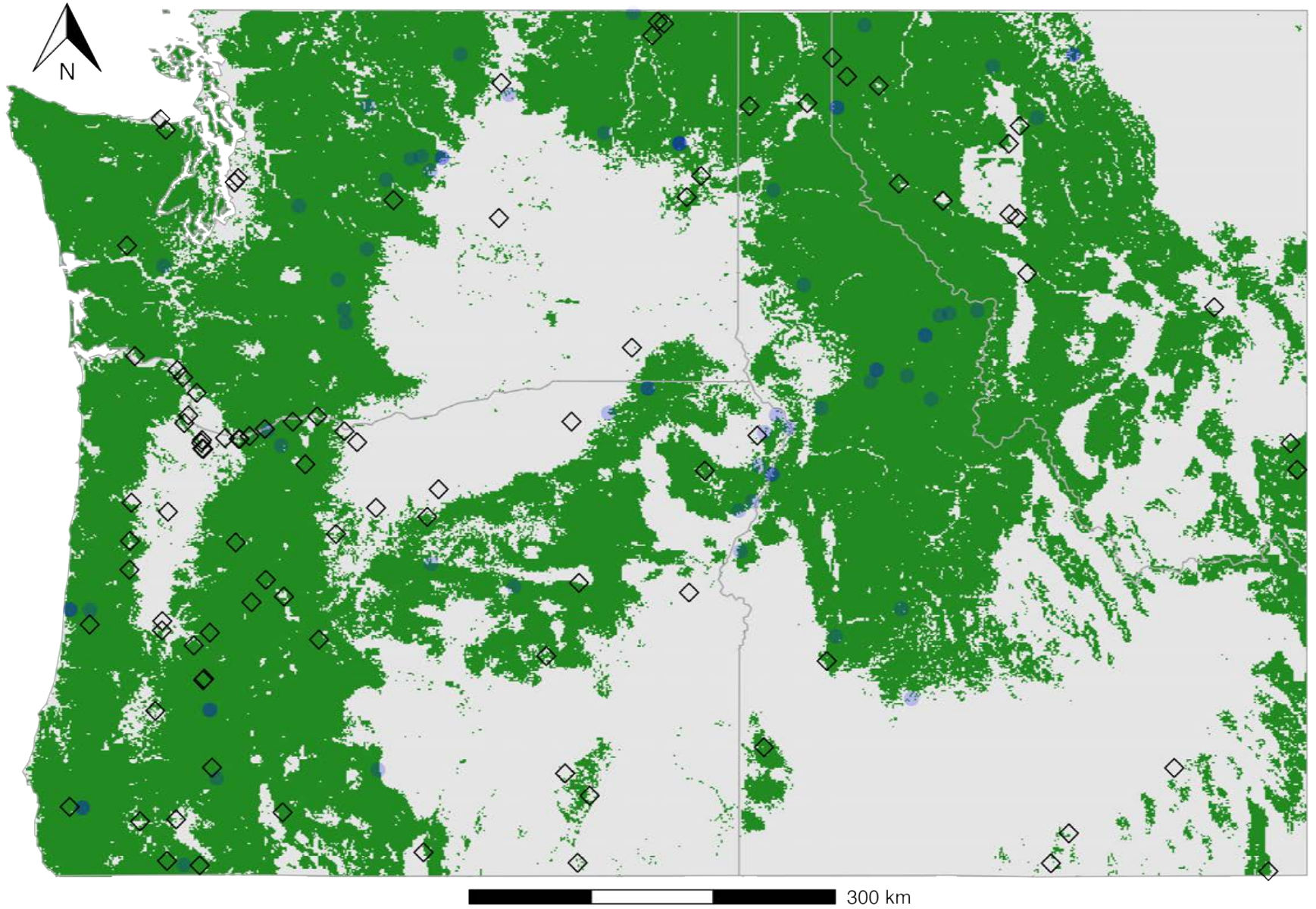
Scouler's willow (n = 2573)

Salix scouleriana



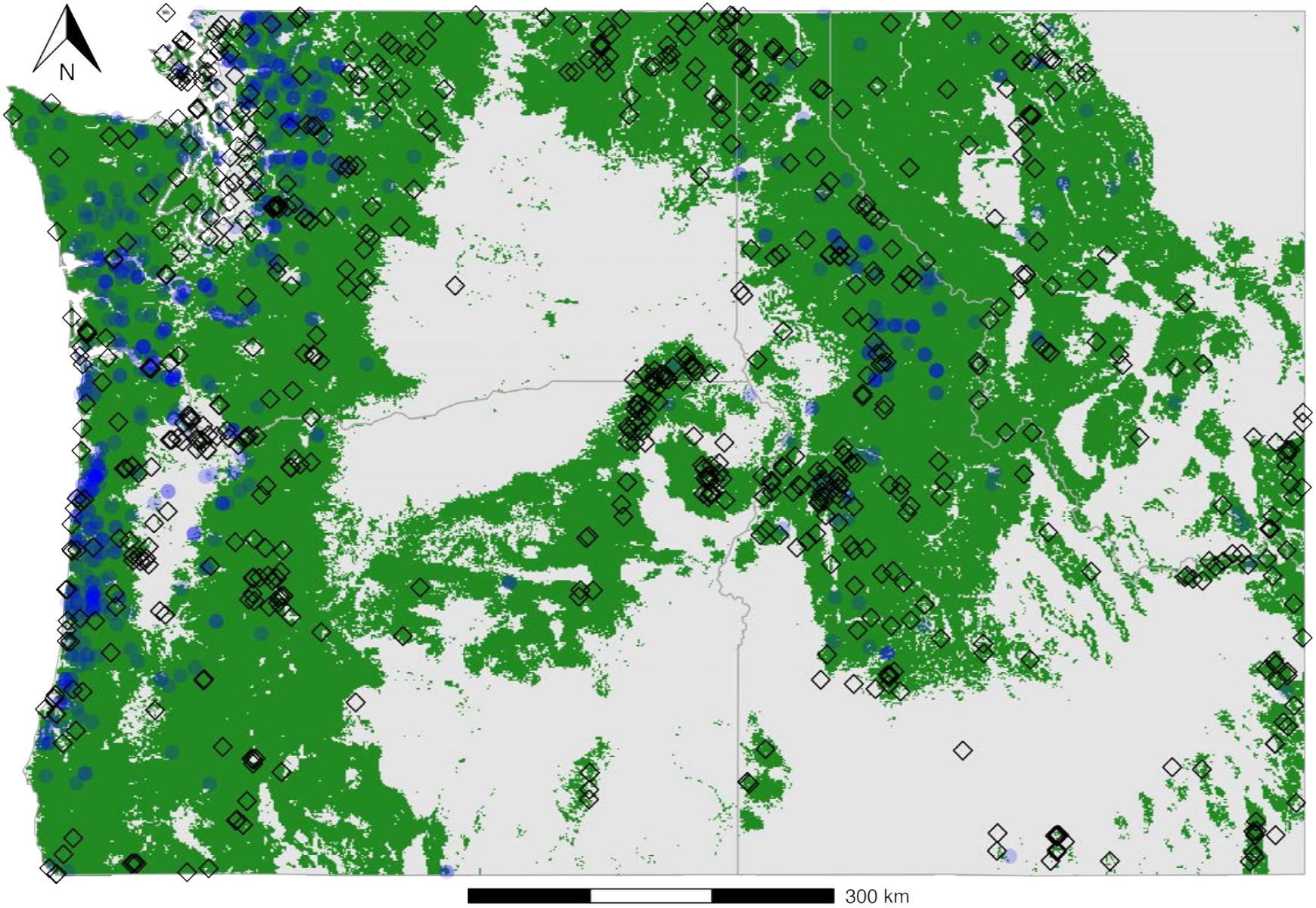
black elderberry, black elder (n = 166)

Sambucus nigra



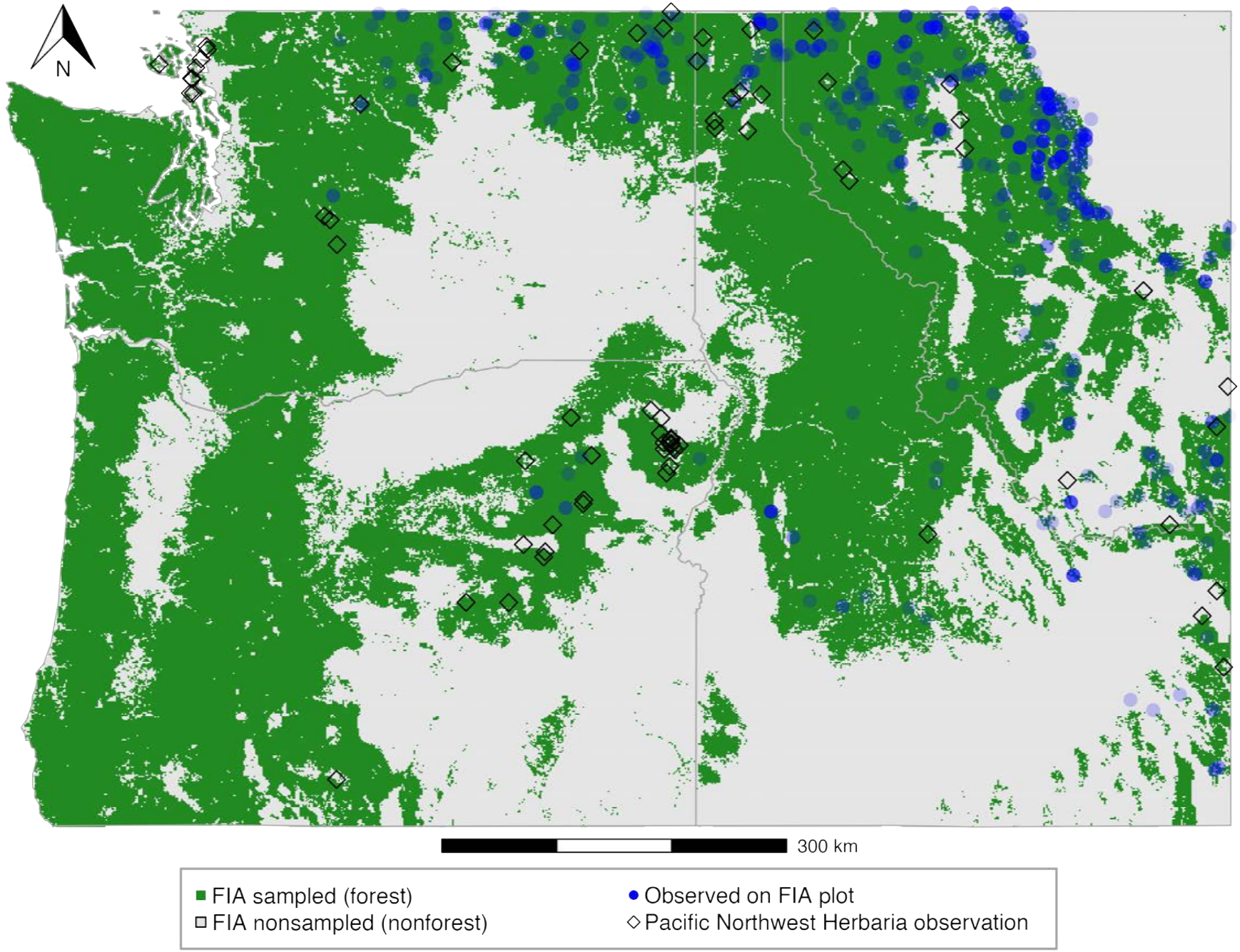
red elderberry, red elder (n = 1256)

Sambucus racemosa



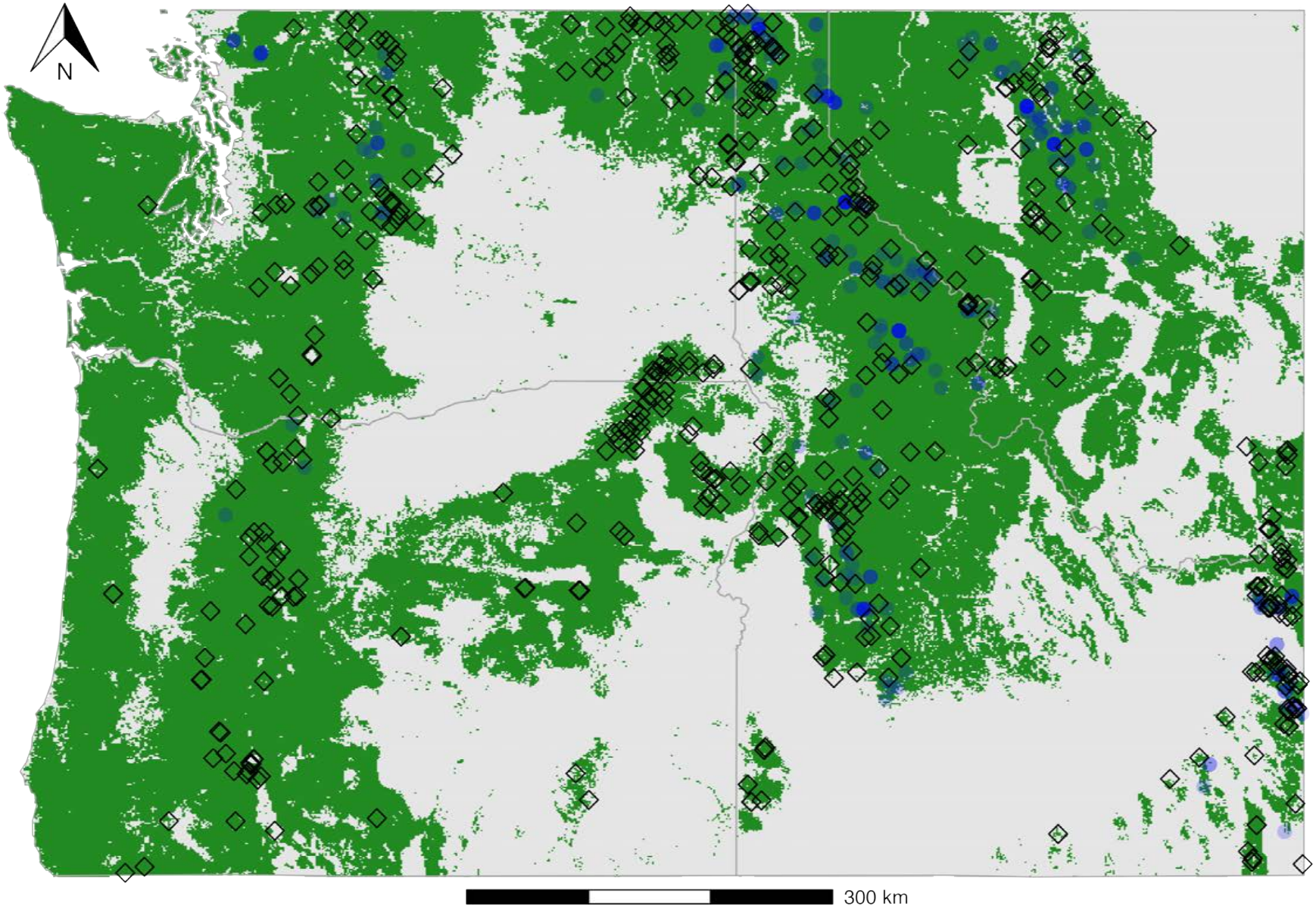
russet buffaloberry, soapberry (n = 384)

Shepherdia canadensis



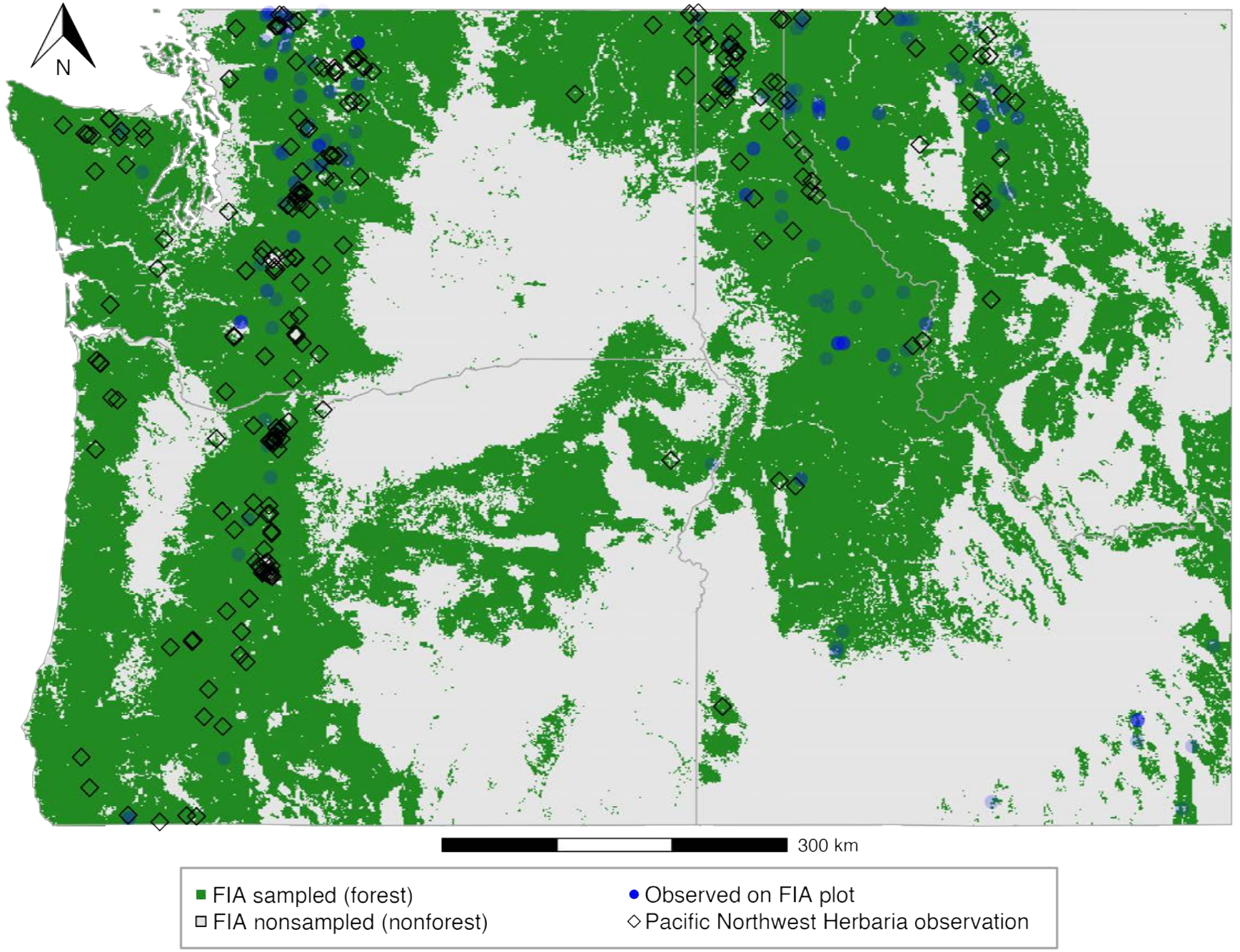
Greene's mountain ash (n = 752)

Sorbus scopulina

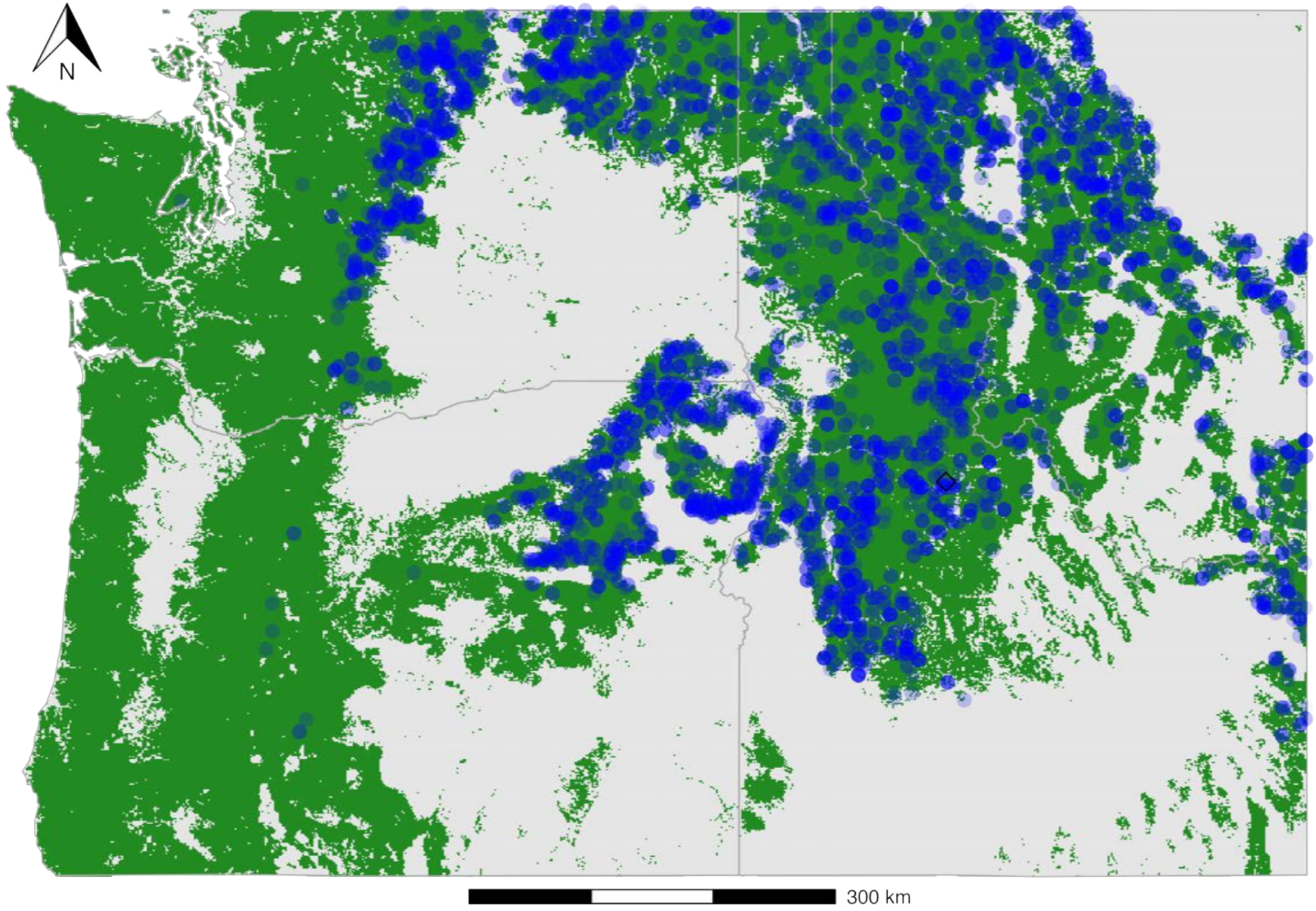


western mountain ash (n = 429)

Sorbus sitchensis

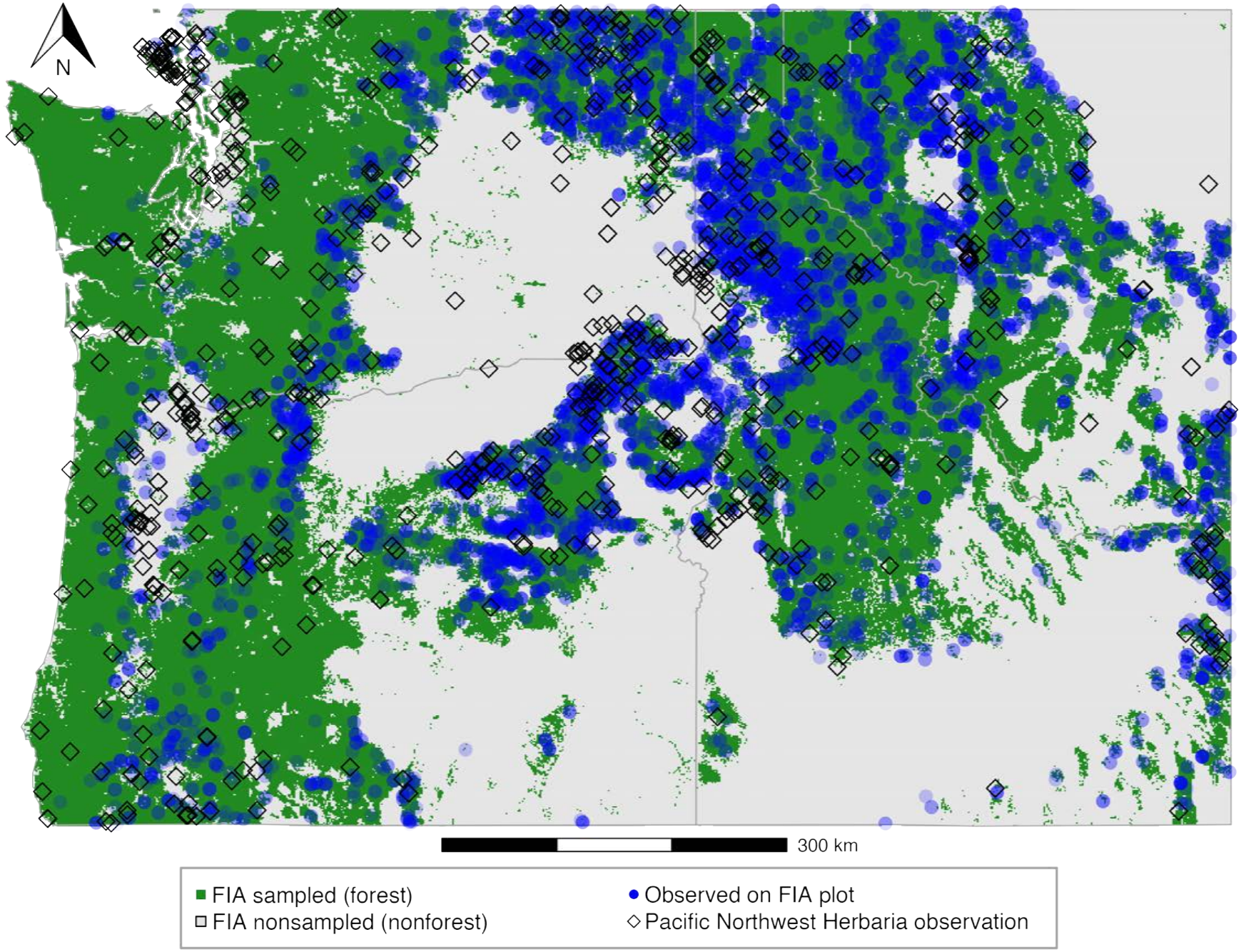


white spirea (n = 1970)
Spiraea betulifolia

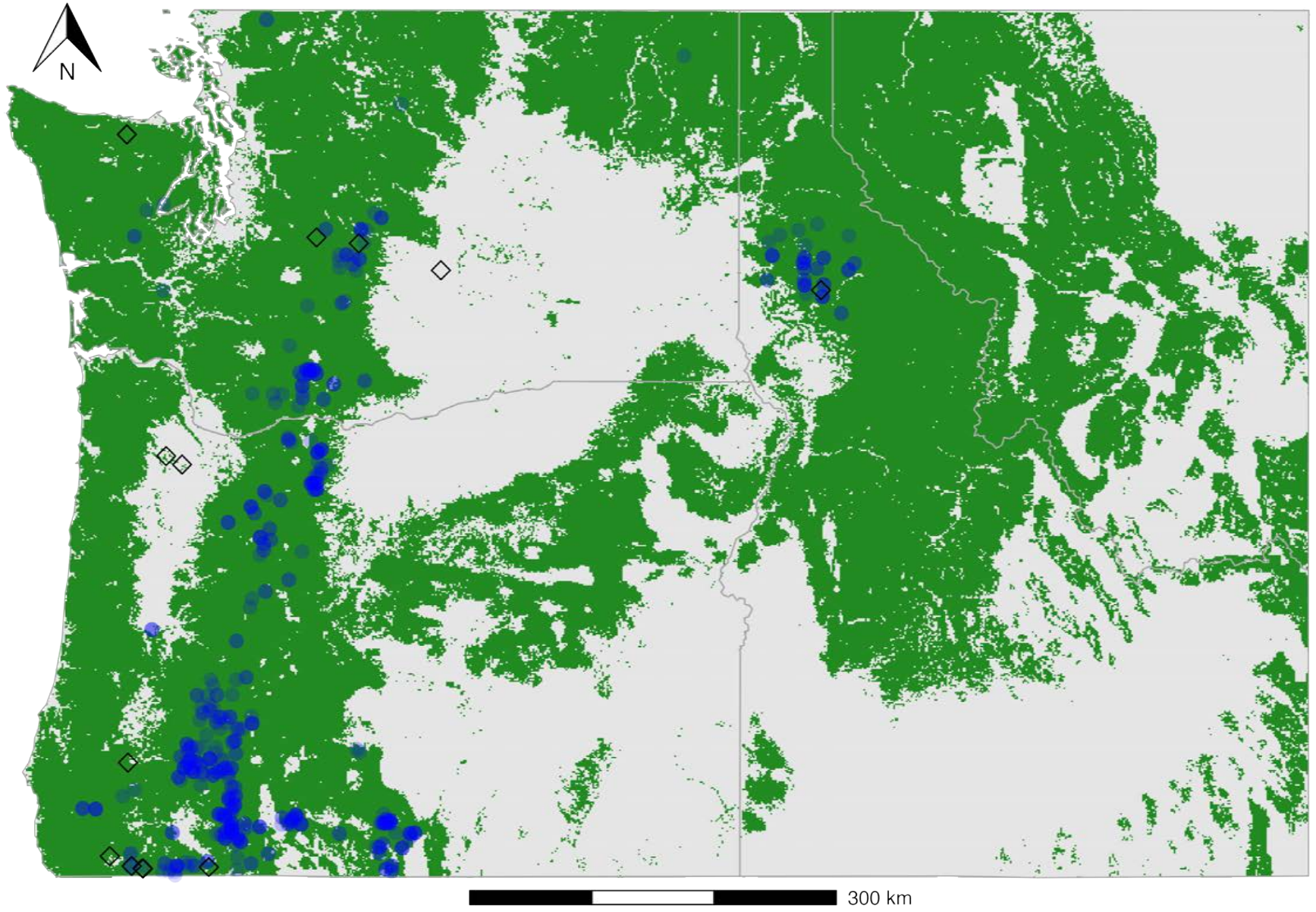


common snowberry, waxberry (n = 3515)

Symphoricarpos albus

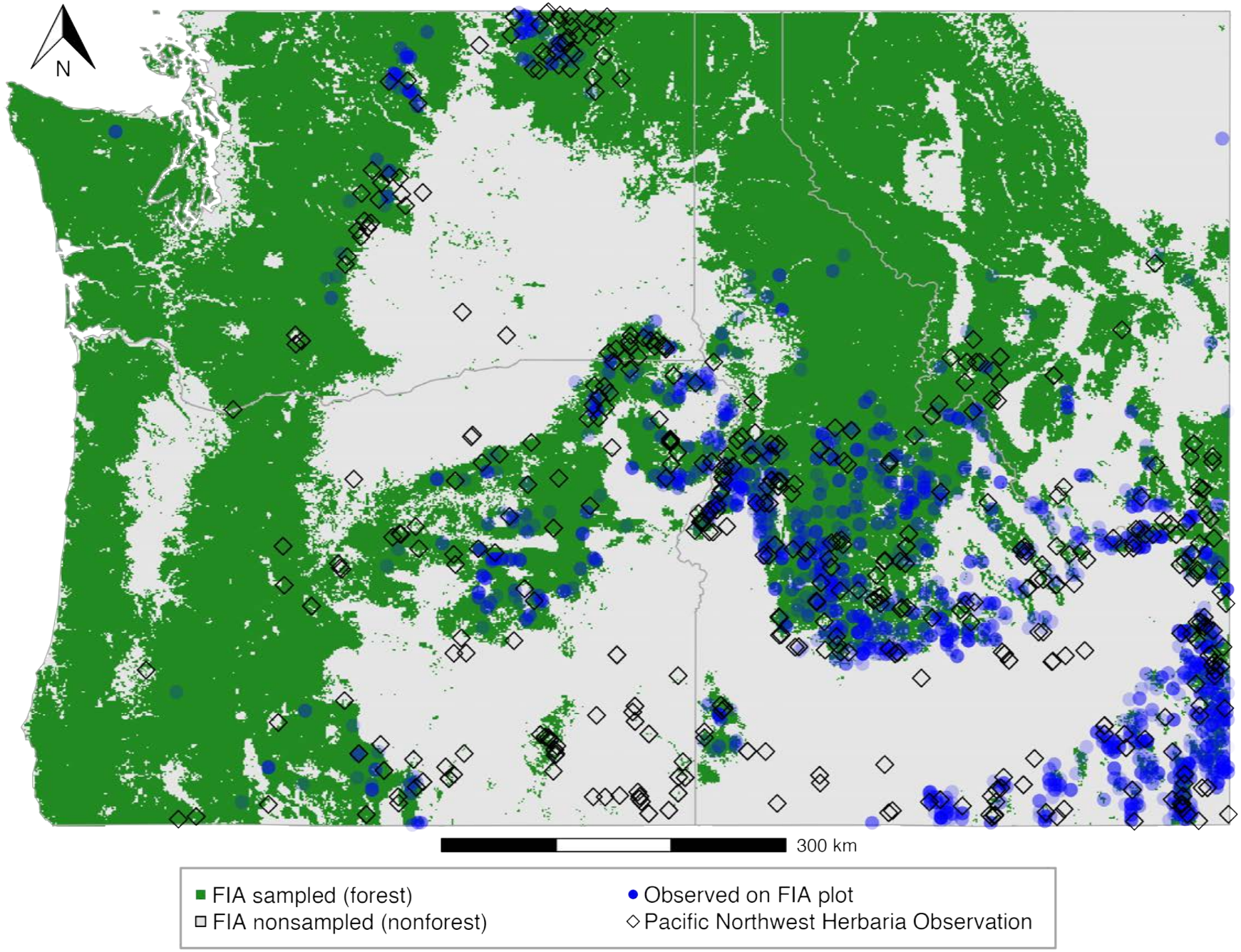


trailing snowberry (n = 269)
Symphoricarpos hesperius



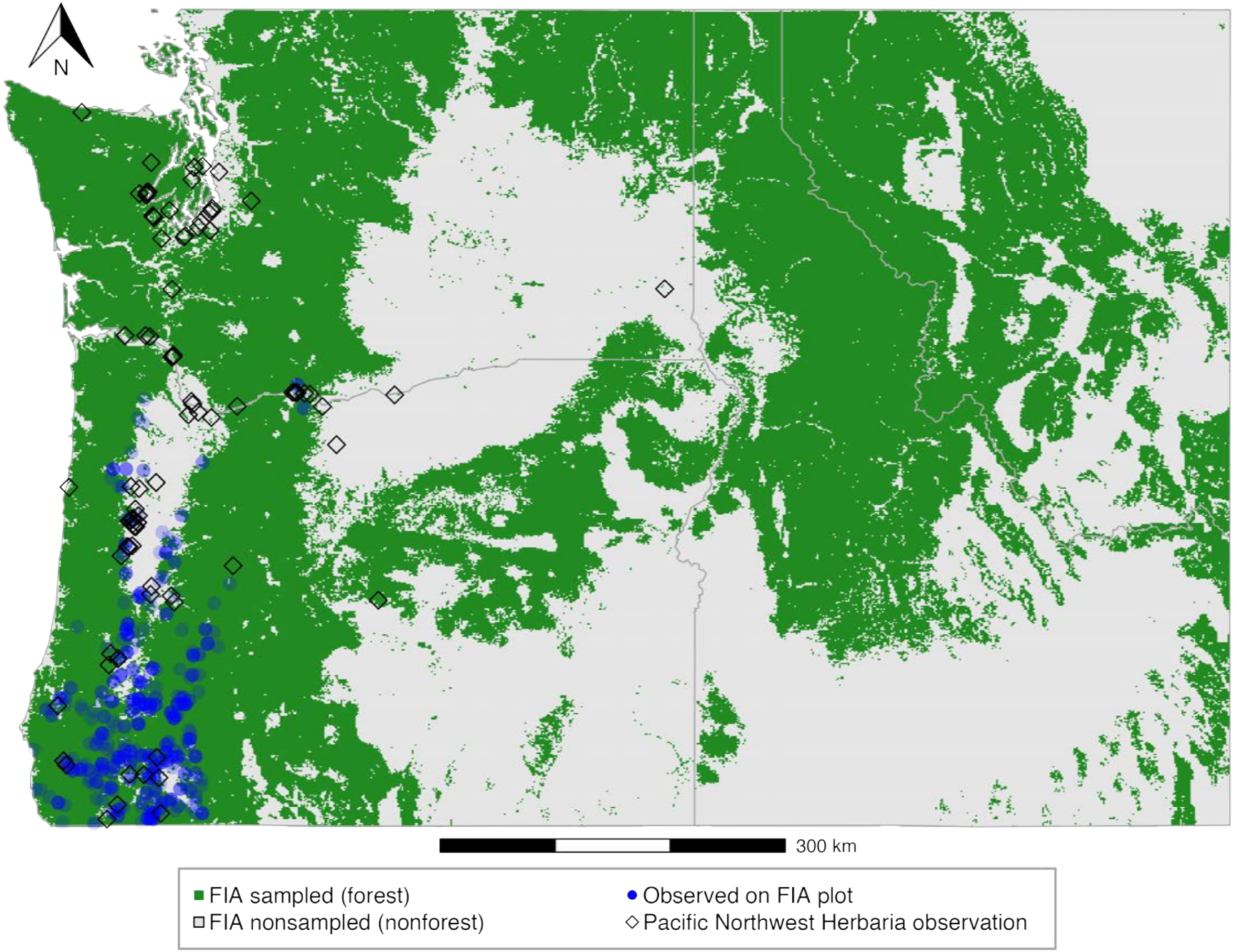
mountain snowberry (n = 1413)

Symphoricarpos oreophilus



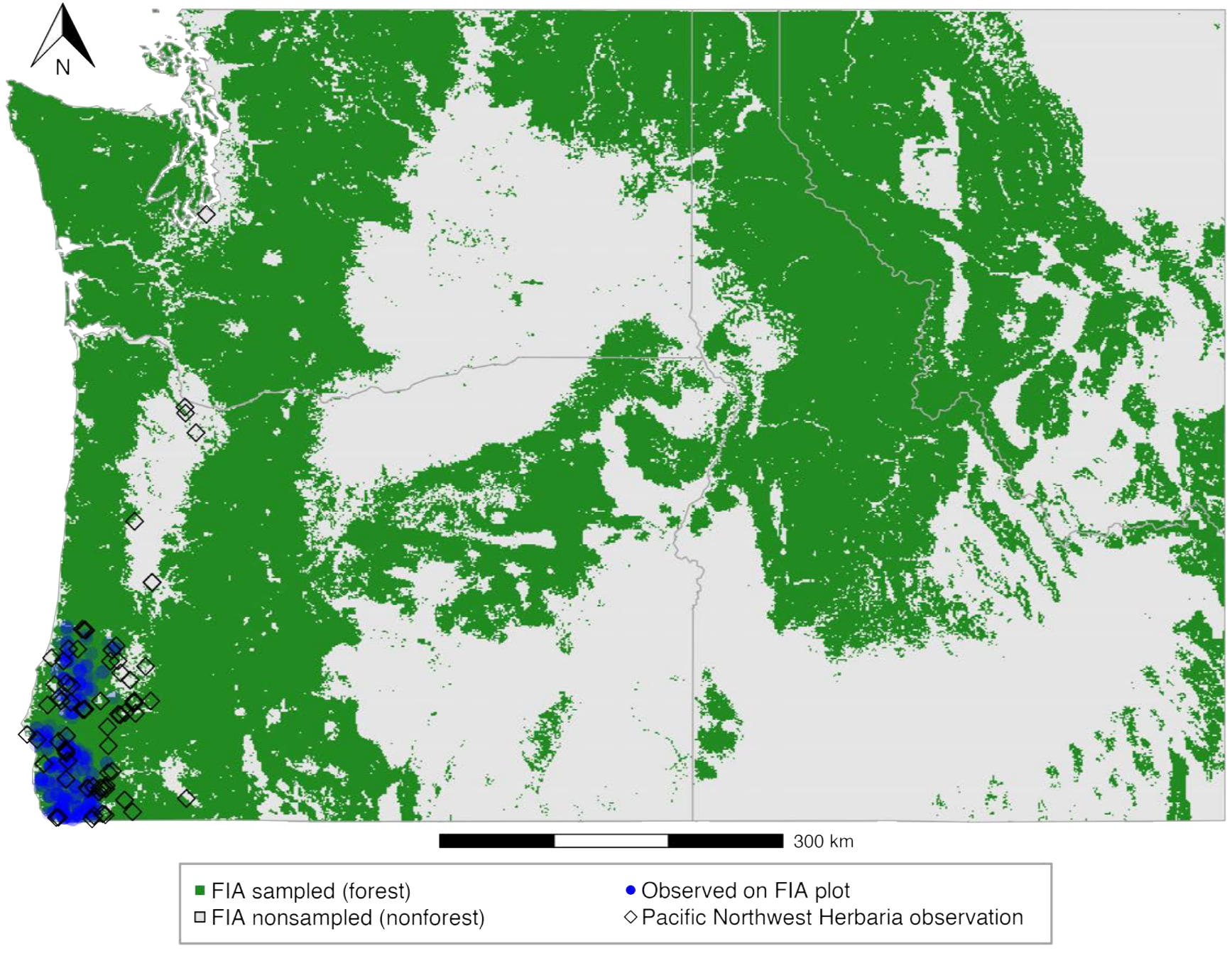
Pacific poison oak (n = 355)

Toxicodendron diversilobum

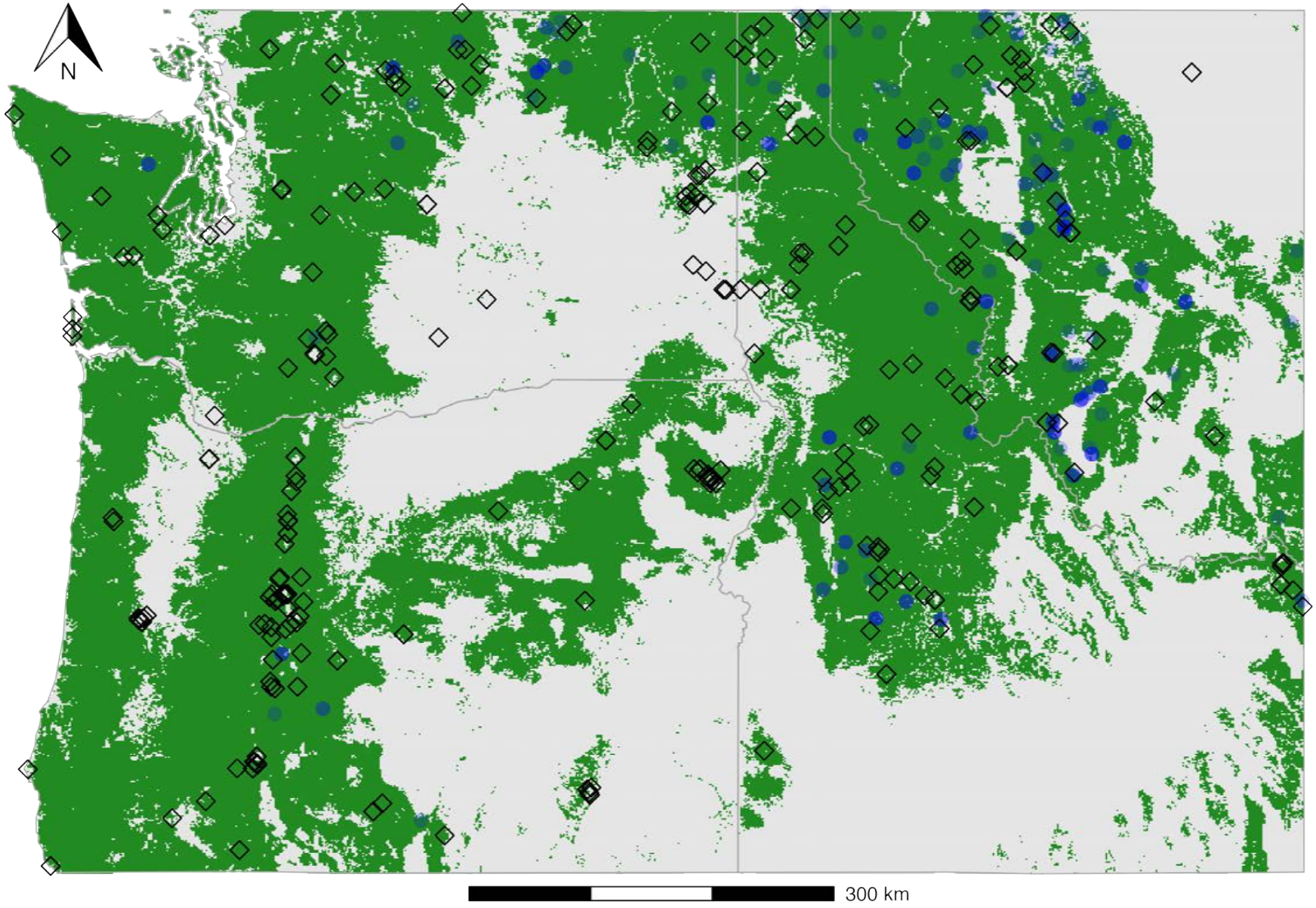


California laurel (n = 231)

Umbellularia californica

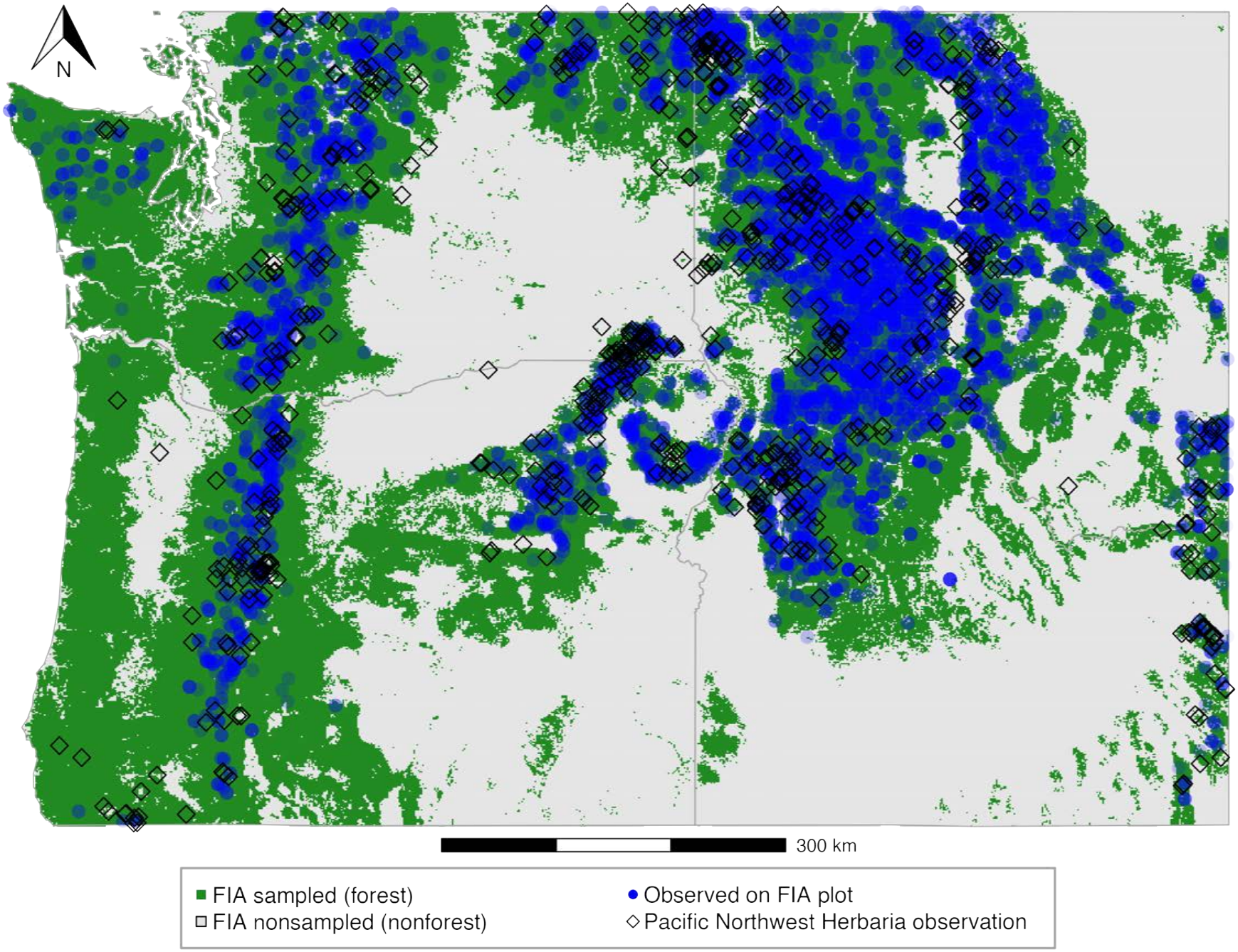


dwarf bilberry, dwarf blueberry (n = 441)
Vaccinium cespitosum

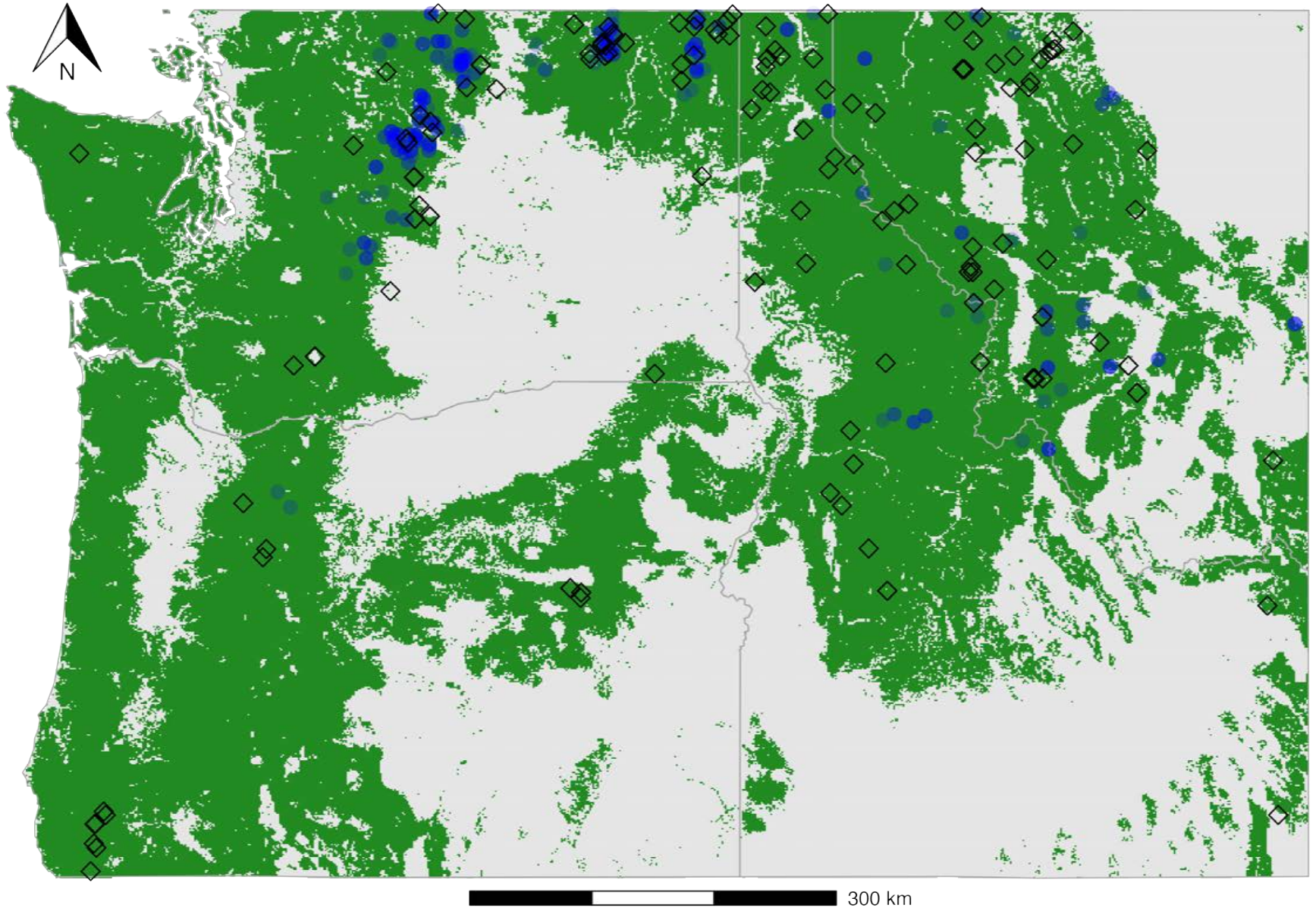


thinleaf huckleberry, black huckleberry (n = 3752)

Vaccinium membranaceum

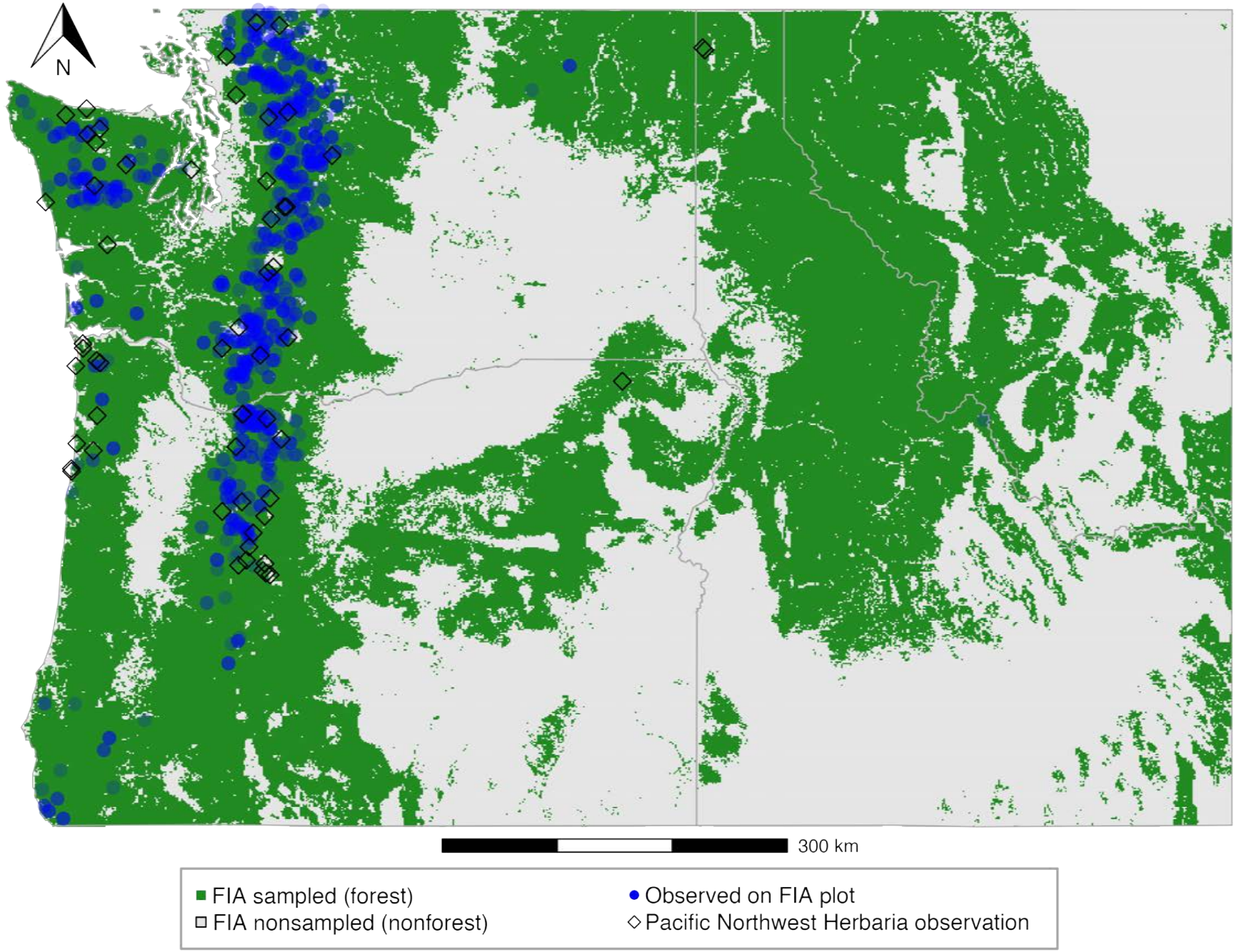


whortleberry (n = 323)
Vaccinium myrtillus



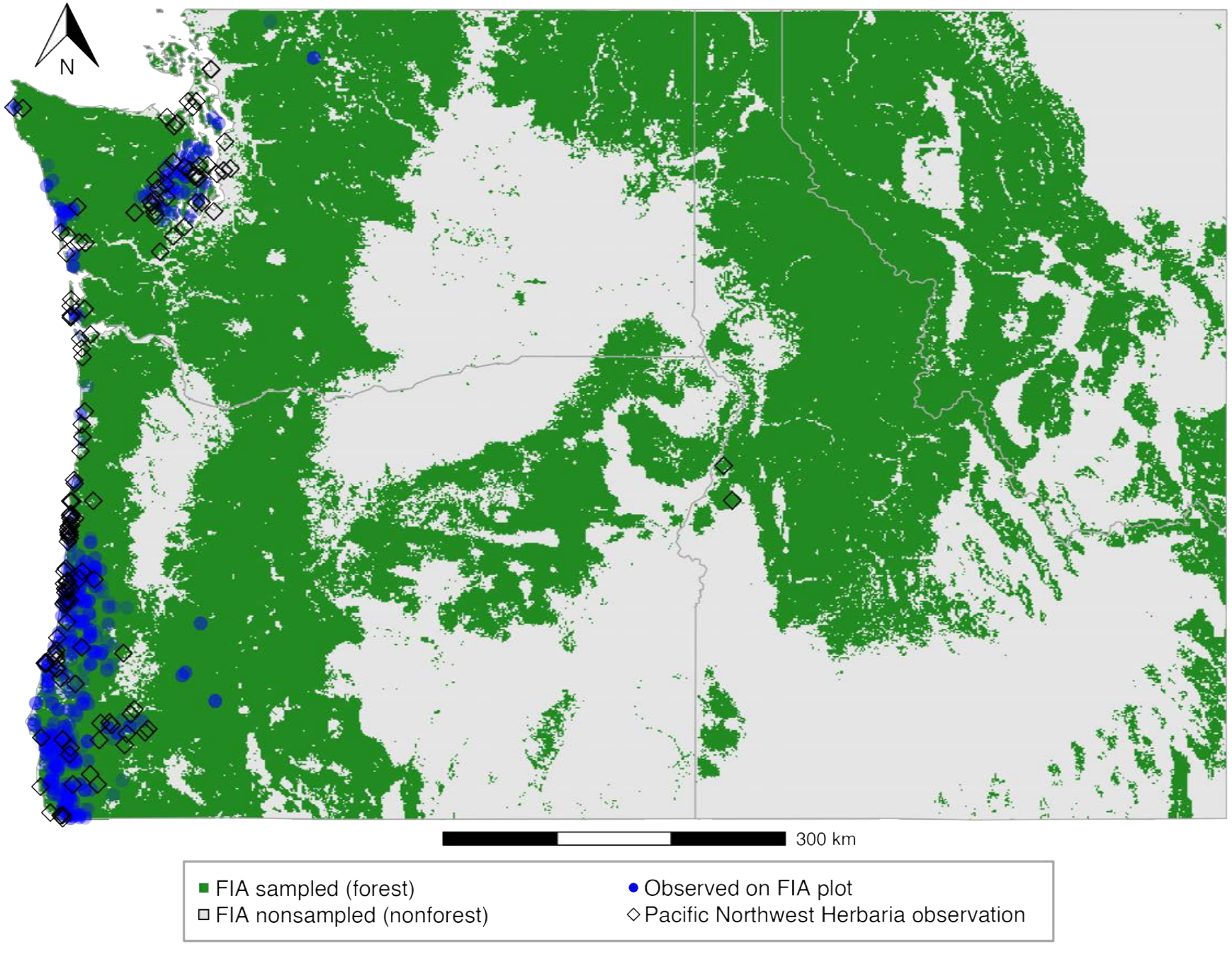
oval–leaf blueberry (n = 541)

Vaccinium ovalifolium

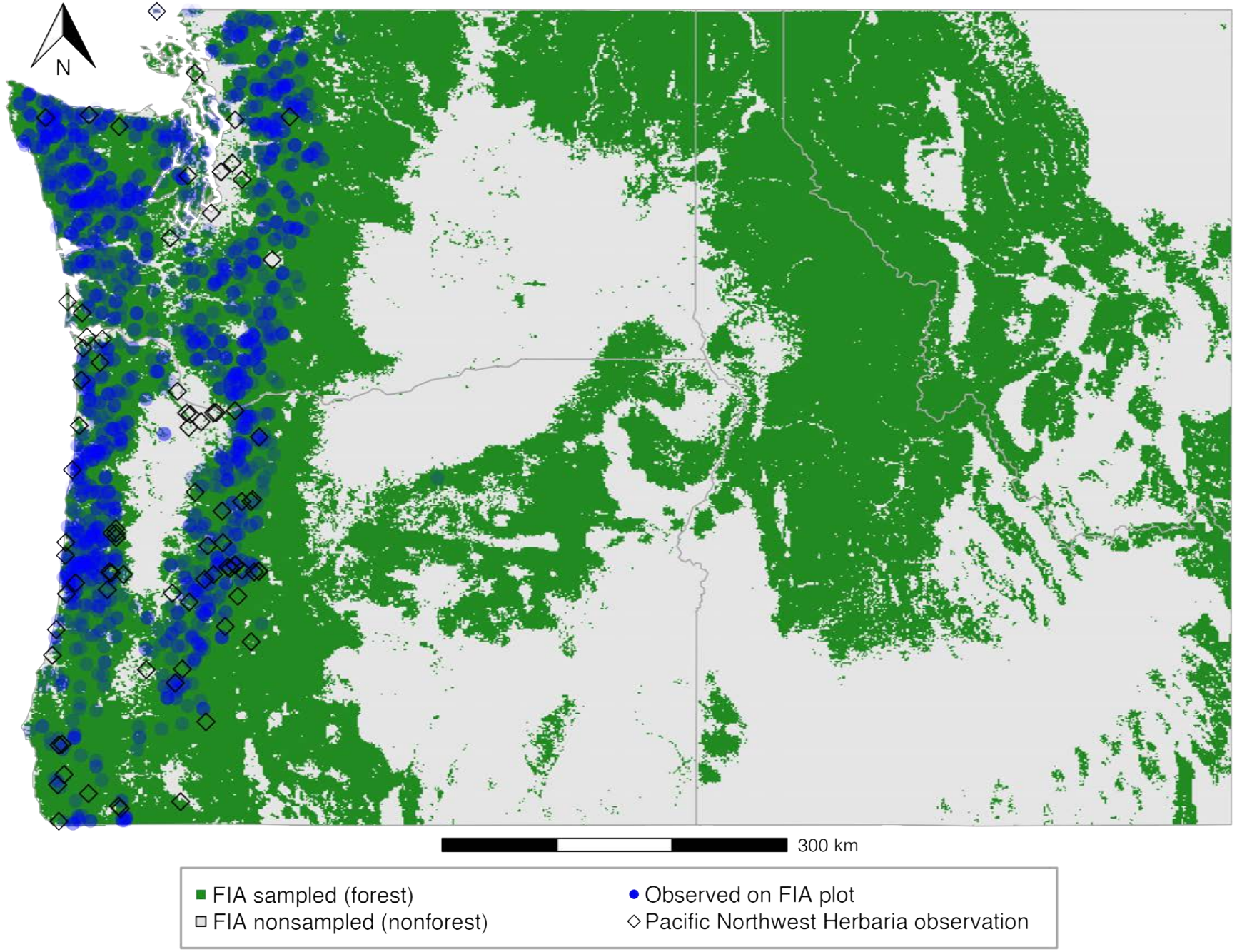


California huckleberry, evergreen huckleberry (n = 489)

Vaccinium ovatum

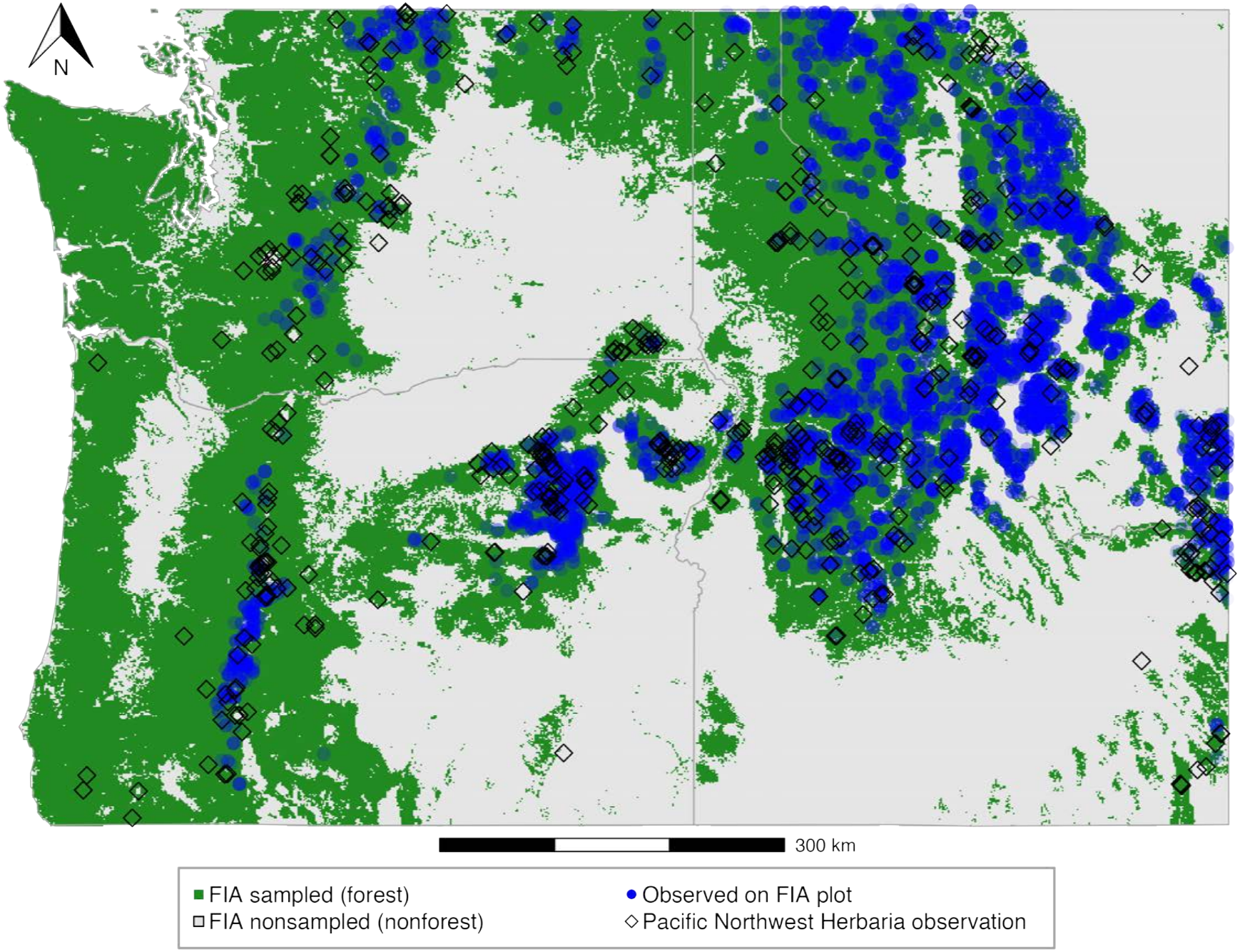


red huckleberry (n = 1056)
Vaccinium parvifolium



grouse whortleberry, littleleaf huckleberry (n = 2486)

Vaccinium scoparium



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