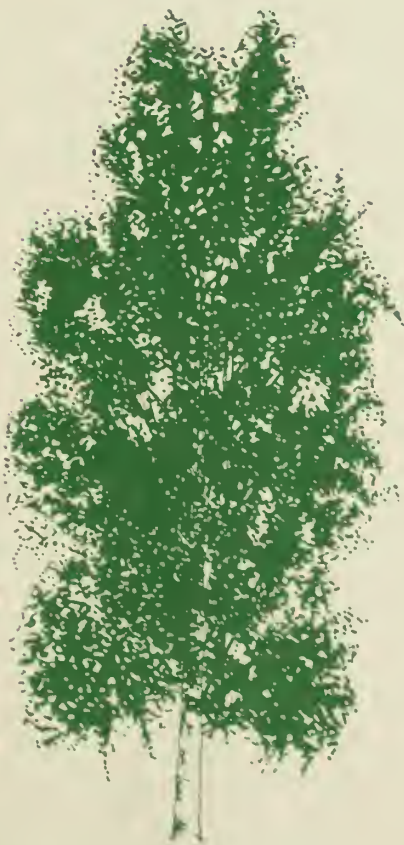


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ATLAS OF UNITED STATES TREES

Volume 2. Alaska Trees and Common Shrubs

by Leslie A. Viereck and Elbert L. Little, Jr.



**ATLAS
OF
UNITED
STATES
TREES**

Volume 2. Alaska Trees and Common Shrubs

by

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This volume is the second of an Atlas with large maps showing the natural distribution or range of the native tree species of continental United States. The 82 species maps include 32 of trees, 6 of shrubs rarely reaching tree size, and 44 more of common shrubs. Range is shown by lines and dots on a map of Alaska, scale 1:10,000,000. Also, 23 general maps summarize environmental factors and supply background information on geography, geology, climate, and vegetation. These basic maps indicate the broad conditions under which each species grows wild and may serve as a preliminary forest atlas of the 49th State.

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¹ Size is indicated by letters: LT, large tree; MT, medium tree; ST, small tree; LS, large shrub; MS, medium shrub; SS, small shrub; PS, prostrate shrub. General distribution is given as I, interior, and C, coastal, with small letter where restricted. The 10 tree species producing nearly all the commercial timber are indicated by an asterisk (*). Explanation under Species Maps and Ranges, page 8.

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ATLAS OF UNITED STATES TREES

VOLUME 2. ALASKA TREES AND COMMON SHRUBS

INTRODUCTION

This volume is the second of an Atlas with large maps showing the natural distribution or range of the native tree species of continental United States, including Alaska. "Atlas of United States Trees, Volume 1, Conifers and Important Hardwoods" (Little 1971²) has an introduction to the series, which may be condensed and adapted here. The project is to be completed in a few volumes within a few years.

Maps demonstrate clearly and graphically where the trees grow wild better than written summaries and have many obvious uses. Assembled in atlas form for ready reference, these distribution maps are available to foresters, botanists, and all others interested in trees for use without restriction, since U.S. Government publications are not copyrighted. Users will render a service toward the improvement of the maps by reporting errors and range extensions. Review and correction is desired for a later, revised edition. The ultimate aim is to produce a set of highly accurate maps of wide acceptance.

Volume 1 contains maps of 200 native tree species, all the native conifers or softwoods, including the needleleaf evergreens (94 species, also 2 shrub species) and the important hardwoods (106 species). Thus, nearly all trees now important commercially for lumber are represented. All of Alaska's 14 species of conifers and the 5 important hardwoods are shown on small-scale maps of North America, scale roughly 1:27,000,000.

Volume 2 has maps of Alaska for 82 native species, including 32 of trees, 6 of shrubs rarely reaching tree size, and 44 more of common shrubs. It follows and supplements also "Alaska Trees and Shrubs" (Viereck and Little 1972). That handbook primarily for identification has descriptions, drawings, small maps, and additional information for 128 species, including the remaining shrubs not illustrated in this Atlas volume.

The reasons for a separate volume of the Atlas for Alaska are clear. The largest State cannot be included within a map of the contiguous United States. On a map of North America, Alaska must be shown not only in reduced scale but in slightly distorted projection. In a separate map, Alaska can be presented in the normal, familiar projection and at the same large scale as the lower 48 States.

The urgent need for information on natural resources for land-use planning in Alaska is sufficient justification for a timely, promptly published Atlas volume. "In Alaska . . . the most massive redistribution of the ownership and control of lands ever to take place in the history of the nation is now underway," stated Burton

W. Silcock, Federal Co-Chairman Joint Federal-State Land Use Planning Commission for Alaska (Society of American Foresters 1974).

Maps showing the natural distribution within Alaska of each species of native trees and common shrubs will be useful not only in land-use planning but to all persons interested in the land, plants, and animals. It is important to compile related maps also. General maps summarize environmental factors and supply background information on geography, geology, climate, and vegetation. These basic maps indicate the broad conditions under which each species grows wild and may serve as a preliminary forest atlas of the 49th State.

HISTORY OF TREE DISTRIBUTION MAPS

Forestry activity in Alaska began with the designation of the valuable coastal forest lands as forest reserves between the years 1892 and 1902. These areas became the Tongass and Chugach National Forests in 1907. The former has since been divided into the North Tongass and South Tongass National Forests.

The history of tree distribution maps in the United States has been reported in Volume 1, while early work by the Forest Service has been reviewed by Little (1951). George B. Sudworth, first dendrologist of the Forest Service, began work with the Bureau of Forestry in 1886 and compiled tree ranges in his check lists published as early as 1897-98. "Forest Trees of the Pacific Slope" (Sudworth 1908) contains much detailed information about tree ranges in Alaska.

Soon after establishment of the Forest Service in 1905, Sudworth undertook a project of preparing a distribution map for each native tree species of North America, exclusive of those occurring wholly in Mexico and minor tropical trees of southern Florida. Many thousand locality records for individual species were compiled on separate cards from publications such as botanical lists and forest surveys, unpublished field notes, and herbarium specimens. For each species these localities were plotted by number on one or more large cloth-backed maps of contiguous United States, North America, or Alaska. These maps and card file are preserved in the dendrology project, Division of Timber Management Research, USDA Forest Service, Washington, D.C., and copies of some Alaska maps also in the National Archives.

Publication of these maps was begun by Sudworth (1913) under the title, "Forest Atlas—Geographic Distribution of North American Trees." Only "Part I—Pines" ever appeared. It is indeed unfortunate that the entire Atlas, with a map for each of nearly 500 native tree species then distinguished was not published soon afterward, when the maps represented current knowledge. For the common trees of Alaska, these early maps have a surprisingly

² Names and dates in parentheses refer to Selected References, p. 17.

large number of documented localities. These dots were mostly along the coasts and rivers, because transportation was by water.

Some years later, Munns (1938) published distribution maps of 170 important forest tree species of the United States. With minor additions, the maps were based very largely upon data by Sudworth, who died in 1927. Ranges of 16 tree species of Alaska were shown in solid black on maps of North America or portions. Revised maps of 14 important tree species of Alaska were compiled by the junior author for "Silvics of Forest Trees of the United States" (Fowells 1965).

Other publications of the Forest Service, USDA, have been devoted to maps of the trees of a single State. In 1941-50, its Forest Survey published distribution maps of commercial forest trees in four southeastern States, Mississippi, North Carolina, South Carolina, and Virginia. Detailed maps of forest trees in California, begun some years ago by the California vegetation-type survey, have been prepared also (Griffin and Critchfield 1972). Altogether, more than one-fourth of the States now have publications with distribution maps of all or most native tree species, as noted in the first volume (Little 1971, p. 5).

While foresters were working in Alaska, explorers and botanists were making plant collections. Hultén (1940a, 1941-50, 1967, 1968) prepared both a history of botanical exploration and comprehensive bibliographies on Alaska plants. Also, Hultén (1937, 1941-50, 1960, 1968) published species maps with dots based upon herbarium specimens not only for trees but for the entire flora of seed plants and ferns.

Of course, botanical exploration of the 49th State expanded greatly with increased settlement and improved transportation from the time of World War II onward. The Alaska Highway and other highways opened large areas, while the cities and smaller settlements have been connected by scheduled airline flights. Small airplanes capable of landing on short airstrips or on water, also helicopters, travel to remote sections. Besides, vegetation has been studied from the air and mapped by airphotos.

Hultén (1968) presented two small maps of each species in his "Flora of Alaska and Neighboring Territories." One map with dots and lines shows the range in Alaska, Yukon Territory, and adjacent parts of Canada. The other map of the northern hemisphere, much reduced, indicates by lines the global distribution patterns.

In adjacent Canada, Hosie (1969) has published small maps of the native tree species. Calder et al. (1968) included small dot maps in their "Flora of the Queen Charlotte Islands", British Columbia. Similar dot maps are being prepared for the flora of British Columbia, a few parts of which have appeared.

PREPARATION OF THE MAPS

The maps in this volume have been compiled from various sources, following the procedure reviewed in the first volume. Principal records include publications, herbarium specimens, field work by the authors, and review by botanists, foresters, and others. Most publications consulted are listed under Selected References (p. 17).

The authors have compiled distribution records while visiting most parts of Alaska except the Aleutian Islands. A report on their collections of woody plants in 1972 with local lists and notes on range extensions will be published elsewhere. Sets of their specimens have been deposited in the Forest Service Herbarium at Fort Collins, Colo., the Herbarium of the University of Alaska

at Fairbanks, the United States National Museum of Natural History at Washington, D. C., and other herbaria.

Beginning in 1949, Viereck has been employed in Alaska with various Federal and State agencies and since 1963 with the Forest Service. He has conducted botanical field work and made plant collections in the following areas during the indicated periods: 1954, interior Alaska and Brooks Range; 1956 and 1958, Mt. McKinley National Park; 1957, coastal Alaska, primarily Prince William Sound; 1959-60, Capes Thompson and Lisburne, northwestern Alaska; 1961, Tonzona River, Alaska Range; 1962, Dry Creek, Alaska Range; 1963-73, Yukon and Tanana River lowlands; 1965, Yakutat Foreland; 1967, southeastern Alaska including Haines, Juneau, and Ketchikan and south-central Alaska, Kenai Peninsula; 1969, Wood River Lakes, Dillingham area, southwestern Alaska; 1972 (with Little), in the Southwest at Yukon Delta, Lower Yukon River, Bethel, Dillingham, Katmai National Monument, Afognak and Kodiak Islands; 1973, Copper River Delta.

Little made collections of woody plants at numerous localities of Alaska in the field seasons of 1961 and 1972. The first year he traveled through the Southeast from Portland Canal to Skagway and Yakutat (by launch from Ketchikan to Juneau). Field work in the interior was mostly in the southeastern part from Homer, Anchorage, and Fairbanks eastward and at Firth River, Fort Yukon, Galena, and McGrath. In 1972 he collected through the Southeast again, including Hyder, Stikine River, and Haines, and in the Southwest with Viereck, also at Kotzebue, Noatak, and Kiana in the Northwest, and Prudhoe Bay on the Arctic Ocean.

"Alaska Trees and Shrubs" (Viereck and Little 1972) contains small species maps compiled by the senior author. The excellent dot maps of each species by Hultén (1941-50, 1968) served as the logical starting point for maps in this Atlas volume as well as in that handbook. The dots for each species were copied on Alaska Map A (published by the U.S. Geological Survey), which was somewhat larger and served as a working map. Where the precise location was uncertain, the place of collection was verified in the earlier reference. For the genus *Salix*, willow, the later species maps for Alaska by Argus (1973) were used. Dot maps in "A Flora of the Alaskan Arctic Slope" (Wiggins and Thomas 1962) were examined also. Several recent publications and unpublished lists contributed additional records and range extensions.

Next, each map was checked at the University of Alaska Herbarium (ALA) at Fairbanks. That important source contains many relatively recent collections from localities not previously covered. Dots, often numerous, were added to each map from data on labels. However, it was not practicable to enter all places crowded near centers such as Fairbanks nor to record the source of every dot. Specimens by the authors were included.

Then, lines representing the limits of distribution for each species were drawn conservatively around the dots, mostly along vegetation type boundaries or similar altitudinal zones. Each species map was compared on a light table with the colored vegetation map of Alaska, slightly simplified, by the senior author (Viereck and Little 1972).

Photocopies of the maps reduced one-half to the final size were circulated to several reviewers, including botanists, foresters, and others with extensive field experience in Alaska. These specialists contributed numerous additional dots, some representing range extensions, and important notes. Last, the authors compiled and incorporated the changes into each map and naturally are responsible for all errors. The final maps were drafted by Barbara H. Honkala, research botanist, who made the cover drawing also.

EXPLANATION OF THE MAPS

"Volume 2, Alaska Trees and Shrubs" contains maps of 82 species of native woody plants, 32 of trees, 6 of shrubs rarely reaching tree size, and 44 more of common shrubs. The shrub species mapped, about one-half of the total, include the more common or widely distributed, those of large size, and those of economic importance.

The species and species maps are arranged by plant families and are numbered for convenient reference. Within large families the order is alphabetical by scientific names. For each species the preferred common name and the accepted scientific name are the same as in "Alaska Trees and Shrubs." Other names in use may be found in that handbook.

Distribution of each species in Alaska is shown in brown on a black-and-white base map. Alaska Map A of the United States Geological Survey (1947, reprinted 1971) was adapted for this purpose. That widely used map is about 16½ by 23½ inches, scale 1:5,000,000, too large for a book.

Atlas Volume 2 has page dimensions of approximately 9¼ by 11¾ inches, somewhat less than Volume 1, 12½ by 14 inches. The smaller size has advantages, including lower printing costs and retail price, compactness, and convenience. Thus, the maps of Alaska have been reduced to one-half or about 8 by 11 inches, scale 1:10,000,000. It was necessary to trim the right margin slightly, because of page dimensions. General Map 2 is Alaska Map A reduced without other changes to one-half, black-and-white, scale about 158 miles to 1 inch (100 km. to 1 cm.).

All species maps in this volume have the same size and scale, 1:10,000,000. The entire State is displayed, even though the distribution may be restricted. Thus, the ranges of different species may be compared readily with one another and with the general maps. Also, the base maps of contiguous United States for the 200 tree species in Volume 1 have the identical scale. Therefore, distances and areas in Alaska and the lower 48 States can be compared visually and directly. Then, beside the smaller States, the vast expanse of Alaska becomes better understood.

The black-and-white base for the species maps has been simplified by the elimination from Alaska Map A of place names, towns, and railroads, which may be found on General Map 2. Highways have been brought up-to-date through extended lines. To aid orientation there have been added 20 small dots (or rings) at cities, towns, and key points scattered over the State. These dots, roughly from north to south and west to east, are located as follows: Barrow, Prudhoe Bay, Kotzebue, Nome, Bettles, Fort Yukon, Fairbanks, McGrath, Bethel, Dillingham, Kodiak, Anchorage, Seward, Valdez, Yakutat, Skagway, Juneau, Sitka, Wrangell, and Ketchikan.

The natural distribution or range of a tree or shrub species, as mapped in this Atlas, is the geographical area where the species, including all varieties, is native or wild. Varieties have not been mapped separately, and hybrids are omitted. Mapping is as of the present time, exclusive of changes caused directly or indirectly by European inhabitants. In Alaska the changes in range limits following European settlement are believed to be negligible or recognizable.

Natural distribution or range of each species is printed clearly in brown on the black-and-white base map of Alaska. Borders of range are shown by lines, except where ocean or lake shores form natural boundaries. The area occupied is filled in by dots

(stippling). Broken lines along the limits of several species indicate uncertainty of the exact position.

Within the range limits, locality records are shown also by dots. These dots are based mainly upon published records, including floras and lists, herbarium specimens, and unpublished sight records by the authors, other observers, and reviewers. Diameter of the dots is almost 3/16 inch (4 mm.), approximately 25 miles (40 km.). The large size needed for visibility on a map thus compensates for minor errors in location and plotting.

Outlying stations or outliers are shown likewise by dots or, if larger, also by lines. However, the smallest areas, such as a grove with only a few trees, must be enlarged to a dot of similar size. A circle or open dot indicates a remote locality whose record is subject to verification.

Presence or absence is shown, but not abundance or density. Any large areas within the main range where a species is known to be absent, for example, high mountains above the timberline and with caps of ice and snow, are marked by lines or holes unshaded within. Commercial range is not indicated for obvious reasons. Such information becomes out-of-date following cutting of virgin forests, abnormal losses by fire, insects, and disease, and changing demands, practices, and standards in utilization. Altitudinal limits, which vary in different latitudes, are not outlined in detail within mountainous areas.

Thus, the species maps summarize distribution both by dots and by lines and indicate the reliability of the limits drawn, also gaps in the record and where more information is needed. The dots are so numerous that more precise range borders can be indicated than on earlier maps. Botanical exploration in the State has become detailed. Consequently, absence of records of large or conspicuous woody-plant species in certain geographical areas may be significant.

The species maps do not indicate forest types, forest cover types, or vegetation types, which are the subject of General Maps 22 and 23. However, many woody-plant species are characteristic of and largely within certain broad forest or vegetation types.

These maps do not show where a species grows outside the natural range after having been introduced directly or indirectly by the human species, whether planted, escaped, adventive, or naturalized. Records of planted or introduced trees and shrubs outside the continuous natural ranges have not knowingly been plotted. Localities of trees and shrubs planted for forestry, shade, or other uses and of escapes from cultivation purposely have been omitted. Nevertheless, in the future, maps adding forest plantations or other introductions beyond the original occurrence may merit compilation.

Introduced species of trees and shrubs, which are relatively uncommon in Alaska, have been excluded. Only one tree species is classed as naturalized, that is, introduced outside the natural range and thoroughly established and reproducing as though native. European mountain-ash, *Sorbus aucuparia* L., has escaped from cultivation locally in southeastern Alaska.

Distribution of the tree and shrub species in this volume is not mapped outside of Alaska. However, similar maps of the same species elsewhere are available in other publications or are in preparation. As previously noted, Volume 1 contains small-scale maps of North America of Alaska's 14 species of conifers and 5 important hardwoods, including ranges across Canada. The remaining native tree species ranging south to the contiguous United States will be treated likewise in the forthcoming volume on minor western hardwoods.

GENERAL MAPS

In addition to the 82 species, this Atlas volume contains 23 general maps, cited in the list of General Maps under Contents. The plan follows that of the first volume, which has 2 base maps with place names and special details of the environment added as 9 transparent overlays.

Besides the 2 base maps (General Maps 1 and 2), Volume 2 has 21 maps of Alaska summarizing environmental factors and supplying background information on geography, geology, climate, and vegetation. The aim has been to assemble the available Alaska maps of significant environmental factors related to plant distribution and forestry, especially in land-use planning. However, small-scale maps cannot show minor variations or local differences, such as in mountainous areas.

It is hoped that these maps will provide a better understanding of the Alaskan environment as well as some insight into the reasons for the varied distribution patterns of the tree and shrub species. Also, correlation with range borders may suggest which environmental factors may be limiting. These basic maps indicate the broad conditions under which each species grows wild and may serve as a preliminary forest atlas of the 49th State.

The increased number of general maps in this Alaska volume is readily justified. The largest State encompasses distances nearly as great as across all the contiguous United States and possesses extreme sites for plant growth. Environmental conditions such as temperature and precipitation vary widely within the distant boundaries. Also, the somewhat different factors or features here may be unfamiliar to new residents and visitors from the lower 48 States.

Two maps on vegetation and forests of Alaska (General Maps 22 and 23) have been modified especially for this Atlas. The others have been assembled from various published sources as cited below and are acknowledged with thanks. Publication again here may aid in the circulation and use of these basic maps.

General Maps 6, 8, 9, 11, 15, 16, and 17 are from "Environmental Atlas of Alaska" (Johnson and Hartman 1971) with permission from the publisher, the University of Alaska, the source also of 10 and 20. Numbers 4 and 12 are redrafted from "Major Ecosystems of Alaska" (Joint Federal-State Land Use Planning Commission for Alaska 1973).

The United States Geological Survey prepared the basic maps, in part revised afterwards, for General Maps 2 and 4-9. Those originating in the U.S. National Weather Service (formerly Weather Bureau) or related agencies include 11 and 13-19. Publications of the U.S. Forest Service are the source of General Maps 1, 3, 21, 22, and 23.

1. North America. The general map of North America shows the location of Alaska in reference to the contiguous United States or lower 48 and serves for orientation. This map is adapted from the base map in the first volume (Little 1971, Base Map 2-N). The scale is one-third that of the base maps of Alaska in this volume, approximately 1:30,000,000, about 473 miles to 1 inch (300 km. to 1 cm.). National boundaries and names of countries, also provinces of Canada, are shown. The position of Alaska is indicated by latitude and longitude. However, the 49th State is in slightly distorted projection in the upper left corner, and the Aleutian Islands could not be included.

2. Alaska with place names. The base map from Alaska Map A from U.S. Geological Survey (1947, reprinted 1971), has been trimmed slightly on right margin to conform to page dimen-

sions and reduced one-half in black-and-white without other changes to scale 1:10,000,000, about 158 miles to 1 inch (100 km. to 1 cm.). Comparison with species maps will aid orientation of range boundaries, collection sites, and field work to named cities, towns, highways, mountains, rivers, lakes, islands, etc.

3. National Forests, Parks, and Wildlife Refuges. The map from "Alaska Trees and Shrubs" (Viereck and Little 1972), front end-papers, has been revised by addition of other refuges under Bureau of Sport Fisheries and Wildlife. Shows as of 1974 the areas of federally owned lands dedicated to the management or preservation of Alaska's renewable natural resources. Examples are: Chugach, North Tongass, and South Tongass National Forests; Mount McKinley National Park, Katmai and Glacier Bay National Monuments; Kodiak, Izembek, and Aleutian Islands National Wildlife Refuges (also smaller refuges), Arctic and Clarence Rhode National Wildlife Ranges, and Kenai National Moose Range.

Under the Alaska Native Claims Settlement Act, proposals have been submitted to Congress for large areas of additional National Forests, Parks, and Refuges in interior Alaska. These proposed areas have not been added, pending Congressional action and perhaps revision of boundaries.

4. Topography (contour map). The generalized map shows lands less than 1,000 feet above sea level, lands between 1,000 and 2,000 feet, lands between 2,000 and 5,000 feet, and lands above 5,000 feet (1,000-, 2,000-, and 5,000-foot contours). From colored map, scale about 1:12,000,000, reverse side of "Major Ecosystems of Alaska" (Joint Federal-State Land Use Planning Commission for Alaska 1973). The 5,000-foot contour has been added in this Atlas.

The most productive land zone for plant and animal life is between sea level and 1,000 feet. Also, nearly all the State's population is in that zone. Commercial forests are below 2,000 feet altitude, mostly below 1,000 feet. Above 5,000 feet are perpetual ice and snow, rock, and occasional patches of alpine tundra.

5. Relief. This shaded relief map is from "The National Atlas" (U.S. Geological Survey 1970, p. 58). The relief map in colors by Richard Edes Harrison, scale 1:7,500,000, has been reproduced photographically here in black-and-white. The roughness of the surface and especially the plains, mountain ranges, and ice fields are indicated.

6. Physiography (physiographic provinces of Alaska). This map with names of the main mountain ranges and lowlands has been published in "Environmental Atlas of Alaska" (Johnson and Hartman 1971, plate 6) and is from the U.S. Geological Survey (Wahrhaftig 1965).

Alaska has four major divisions of physical geography, large-scale topography, or landforms. These major North American physiographic divisions in Alaska, from south to north are: the Pacific Mountain System, the Intermontane Plateaus, the Rocky Mountain System, and the Interior Plains or Arctic Coastal Plain. All extend northwest from western contiguous United States through Canada to Alaska, where they bend to the west.

These major divisions have been further divided into provinces, as mapped. Plains and lowlands are generally less than 1,000 feet above sea level. Low mountains, plateaus, and highlands of generally rolling topography have summits of 1,000-6,000 feet in elevation. High rugged mountains have summits of more than 5,000 feet.

The Pacific Mountain System includes the Coast Ranges of the Southeast, St. Elias Mountains, Wrangell Mountains, Kenai-

Chugach Mountains, the Alaska Range, and the Aleutian Range. The Brooks Range is the northern extension of the Rocky Mountains. In the Intermontane Plateaus are the river systems of the Yukon and Kuskokwim Rivers, the Yukon-Tanana Upland, and other uplands.

Mountains are significant to the distribution of trees and shrubs. The Coast Ranges separate the woody plants of the wet coastal forests from those of the drier interior forests or taiga. Also, the Brooks Range has acted as a major climatic barrier to many interior species which reach their northern limits along its southern slopes. The Arctic Coastal Plain lies beyond the northern limit of trees.

7. Geology (generalized). This map is from "Water Resources of Alaska," an open file report published by the U.S. Geological Survey (Feulner et al. 1971). It shows only three broad categories of the basic geology: (1) areas where deposits of alluvium, glacial debris, and wind-blown or eolian sand and silt form a mantle over the subsurface rocks; (2) areas where the bedrock is predominantly of sedimentary and metamorphic rocks; and (3) areas of igneous rocks of both Quaternary and Tertiary volcanics and of older intrusive rocks. This basic geology is important to the formation of soil types, the distribution of trees and shrubs, and to the productivity of individual ecosystems.

8. Extent of glaciation in Alaska. A "Map Showing Extent of Glaciations in Alaska" was compiled by Coulter et al. (1965) and published in color by the U.S. Geological Survey, scale 1:2,500,000. The map in this Atlas is from the simplified map in "Environmental Atlas of Alaska" (Johnson and Hartman 1971, plate 11), scale 1:10,000,000.

Presently Alaska has more than 51,000 square miles of glaciers and perennial or perpetual snow fields. It is then surprising to find that large areas of Alaska were not glaciated during the Pleistocene, even though glaciers occupied most of Canada and the northern United States during parts of that epoch. In Alaska the glaciers were limited primarily to the southern coastal areas and to the main mountain ranges. The major portions of the Yukon and Kuskokwim drainages were not glaciated.

It is possible, then, that many species of trees and shrubs of the interior forests or taiga of Alaska were able to survive either on unglaciated areas in the interior or in areas west of present-day Alaska that are now submerged beneath the Bering Sea.

In southeastern Alaska, glaciation was nearly complete. However, the tops of some islands and mountain peaks, and also some slopes on the seaward side of mountains, may have been refugia for some plants.

9. Permafrost. A "Permafrost Map for Alaska," scale 1:2,500,000, was published by Ferrians (1965), of the U.S. Geological Survey. The map in this Atlas is from the modified and simplified map in "Environmental Atlas of Alaska" (Johnson and Hartman 1971, plate 10), scale 1:10,000,000. Another in color, scale about 1:12,000,000, is on reverse side of "Major Ecosystems of Alaska" (Joint Federal-State Land Use Planning Commission for Alaska 1973).

Permafrost, or permanently frozen ground, as defined by Muller (1947) is "a thickness of soil or other surficial deposits or even of bedrock, at a variable depth beneath the surface of the earth in which a temperature below freezing has existed continuously for a long time (from two to tens of thousands of years)."

In Alaska permafrost, or permanently frozen ground, is found to some degree in all but the southern coastal areas. The map

distinguishes three different zones although, as with climate, it should be recognized that one zone grades gradually into the next.

1. Generally underlain by continuous permafrost. In this zone permafrost is found beneath nearly all surfaces except large bodies of water.

2. Underlain by discontinuous permafrost. In much of the interior basin and extensive areas on the south side of the Alaska Range, permafrost is found under most poorly drained flat surfaces, on north slopes, and in moderately rolling topography. It is usually lacking on south-facing slopes and adjacent to rivers and lakes.

3. Underlain by isolated masses of permafrost. In this zone permafrost is found in isolated patches, usually on north slopes and in low-lying bog areas, but much of the substrate is permafrost free.

4. Generally free from permafrost. Permafrost is lacking or found only rarely in isolated patches in this zone, which includes all of southeastern Alaska, much of south-central Alaska, the Alaska Peninsula, and the Aleutian Islands.

Permafrost has a strong influence on the distribution of trees and shrubs. It limits the rooting depth of plants, creates cold and wet soil conditions, and provides conditions favorable for the accumulation of peat deposits. In the interior basin of Alaska, aspen and white spruce are usually found where permafrost is lacking or at depths of more than 3 or 4 feet, whereas permafrost sites are usually occupied by black spruce and tamarack. Paper birch occurs commonly on both sites.

10. Soils with agricultural potential. At present there is no generalized soil map of Alaska. The map of soils with agricultural potential is simplified from that published in color in "Alaska's Agricultural Potential" (Alaska Rural Development Council 1974, after p. 22) at a scale of 1:6,000,000. It separates upland from lowland agricultural soils and also distinguishes some areas where soils are suitable for farming but where the climate is likely to be marginal or restrictive for agricultural crops. The larger colored map further subdivides agricultural areas into those where 50% or more of the area is suitable for farming and those in which 25-50% of the land is suitable for farming.

Most of the land with agricultural potential lies in the Yukon basin around Fort Yukon, in the Tanana Valley, and in the Cook Inlet-Susitna Valley areas. Smaller areas occur along the lower Yukon River, the Kuskokwim River, and in the Nushagak Valley and tributaries north of Dillingham. It should be pointed out that these areas of good agricultural soils are also sites of potential forest growth and development.

11. Climatic zones. The climatic zones of Alaska were described and delineated by the National Weather Service (Watson 1959) and revised by Searby (1968), of the Environmental Sciences Services Administration. The map in this Atlas is modified from the simplified map in "Environmental Atlas of Alaska" (Johnson and Hartman 1971, plate 26). Another in color, scale about 1:12,000,000, is on reverse side of "Major Ecosystems of Alaska" (Joint Federal-State Land Use Planning Commission for Alaska 1973).

Four climatic zones are recognized for Alaska: Maritime, Transitional, Continental, and Arctic. The Maritime Climate is characterized by high precipitation and a mean annual temperature above freezing, and with a narrow range of variation between summer and winter.

In contrast, the Continental Zone has low precipitation, a mean

annual temperature below 32°F., and an extreme range of temperatures between summer and winter. The Arctic Climate has low precipitation but does not have the wide range of temperatures, the summers being much cooler than those of the Continental Zone. The Transitional Zone has conditions primarily intermediate between Continental and Maritime Zones.

It should be noted that these broad zones cannot take into account local differences caused by variations in altitude. Within the Continental Zone, for instance, there are extensive alpine areas with a climate nearer that of the Arctic Zone than the Continental.

Of all environmental factors, climate has the greatest influence on tree and shrub distribution. Many species are limited to one climatic zone, and most have an optimum development in one zone, although found occasionally in another. Thus, one group of tree and shrub species is confined to the mild, humid coastal areas, whereas another group is limited to interior Alaska with its hot, dry summers. Trees and tall shrubs in the Arctic Zone are restricted to the warmest, most favorable sites.

Precipitation and mean annual temperatures of the climatic regions are given in the following table from "Major Ecosystems of Alaska" and credited there to Watson (1959).

CLIMATOLOGICAL DATA FOR ALASKA

Climatic Zone	Annual precipitation (inches)			Annual temperature (°F.)		
	Max.	Min.	Avg.	Max.	Min.	Avg.
Arctic	21	4	7	90	-61	10-20
Continental	24	10	15	100	-75	15-25
Transitional	30	12	17	90	-70	22-35
Maritime	300	11	65	99	-42	35-45

12. Hydrology. For many purposes it is useful to divide Alaska into regions based on the major drainage basins or watersheds. This hydrology map is modified slightly from a colored map, scale about 1:12,000,000, on reverse side of "Major Ecosystems of Alaska" (Joint Federal-State Land Use Planning Commission 1973).

Alaska has 6 major watersheds and 18 subregions. These regions, except the Southeast, are based on major drainage patterns and include:

1. Southeast, with many steep, short watersheds plus the lower sections of several large rivers entering the Pacific Ocean from Canada.

2. South-central, which includes those rivers entering the Gulf of Alaska, of which the Copper River is the largest, the Cook Inlet subregion, dominated by the Susitna River, and the Kodiak-Shelikof subregion, consisting of Kodiak and Afognak Islands and the eastern drainages of the Alaska Peninsula.

3. Southwest region, consisting of the western end of the Aleutian chain and the two main southwestern Alaska rivers, the Nushagak entering Bristol Bay at Dillingham, and the Kuskokwim, the largest watershed in southwestern Alaska.

4. The Yukon region, containing 130 million acres, is by far the largest watershed in Alaska. It is divided into five subregions, the Lower, Central, and Upper Yukon, and its two major tributaries, the Koyukuk and Tanana Rivers.

5. The Northwest region is divided into: (a) all of the drainage into Norton Sound and the south section of the Seward Peninsula; and (b) the drainages into Kotzebue Sound, which includes both the Noatak and Kobuk watersheds.

6. The Arctic region is separated into three subregions: (a) the Colville River watershed, (b) all of the rivers to the east of the Colville River, and (c) all of the drainages to the west and north of the Colville River watershed.

13. Precipitation. This revised map shows the mean annual precipitation in inches for Alaska. It is reduced from the map prepared by the National Weather Service in cooperation with the U.S. Geological Survey, scale 1:5,000,000, and based on all available data through 1972. This map has been published also in "Alaska's Agricultural Potential" (Alaska Rural Development Council 1974, p. 38), scale about 1:11,500,000.

Precipitation includes both rain and snow (melted), but mean annual snowfall is presented in General Map 14. The lines (isohyets) are drawn through points of approximately equal value but are estimated for many mountainous areas. The map takes into account the increased precipitation in higher elevations and thus differs from precipitation maps compiled only from National Weather Service stations, most of which are at low elevations.

Mean annual precipitation varies from more than 300 inches in the southeastern mountains to less than 5 inches in the extreme northern portions of the Arctic slope. Areas of low precipitation also occur in the interior basin between the Alaska Range and the Brooks Range. However, adequate moisture is available for tree growth because of low rates of evaporation and transpiration coupled with an impervious permafrost layer. In spite of this low rainfall, there are large numbers of lakes and bogs and the rivers have a significant annual runoff.

In Arctic Alaska, where precipitation is low, soil moisture is abundant, except in porous rocky soils, because of the nearly continuous permafrost layer close to the surface.

In coastal Alaska the mountains intercept moisture-laden winds blowing landward from the Pacific Ocean, causing very high precipitation rates. In the high altitudes much of this falls as snow, accounting in part for the extensive glaciers and ice fields in this region. At lower elevations the high rainfall and cool summers provide near optimum conditions for tree growth.

14. Mean annual snowfall. The revised map of mean annual snowfall is reduced from that prepared by the National Weather Service in cooperation with the U.S. Geological Survey scale 1:5,000,000, and based on all data available through 1972. This map has been published also in "Alaska's Agricultural Potential" (Alaska Rural Development Council 1974, p. 39), scale about 1:11,500,000. It takes into account the increased snowfall at higher elevations.

Snowfall in Alaska is extremely high in the southern coastal mountains, up to 800 inches per year, but in general drops off to the north and in certain areas of the interior basin to less than 40 inches. South of the Alaska Range, the snow is often melted by winter warm periods, but north of the range the snow usually persists from the time of the first snowfall in September or October until spring melt in April, May, or June.

15. Mean annual temperature (°F.). This map of mean annual temperature (°F.) in Alaska by Harold W. Searby is from "Environmental Atlas of Alaska" (Johnson and Hartman 1971, plate 35), scale approximately 1:10,000,000. The data were obtained primarily from low-lying weather stations and therefore do not record the lower mean annual temperatures that occur in all mountain ranges.

Mean annual temperatures decrease generally from south to north in Alaska. Most parts of the State, except the southeast,

Cook Inlet area, Alaska Peninsula, and Aleutian Islands, have a mean annual temperature below freezing (32°F.). Of course, seasonal temperature variation is significant. Plant distribution may be related more closely to summer temperatures than to the mean annual.

16. Mean July maximum temperature (°F.). This map of mean July maximum temperature (°F.) in Alaska is from Searby (1968, p. 20), scale about 1:15,000,000. It was published also in "Environmental Atlas of Alaska" (Johnson and Hartman 1971, plate 34), scale about 1:10,000,000. As with the other temperature maps, data were taken from weather stations primarily at low elevations and do not show the temperatures in the mountain ranges.

Since July is the warmest month in most areas of Alaska, the mean July maximum lines (isotherms) provide a general picture of summer temperatures in Alaska. It can be seen that the warmest summer temperatures are in the interior basin and especially near the Canadian border. Cooler temperatures are found in all coastal areas. The cooler summer temperatures along the west coast of Alaska and through the Aleutian Islands account, in part, for the southward extension of tundra and the corresponding absence of trees.

17. Mean January minimum temperature (°F.). This map of mean January minimum temperature (°F.) in Alaska is from Searby (1968, p. 19), scale about 1:15,000,000. It was published also in "Environmental Atlas of Alaska" (Johnson and Hartman 1971, plate 31), scale 1:10,000,000. Since January is the coldest month in most of Alaska, the mean January minimum lines (isotherms) give a fairly representative picture of winter temperatures in Alaska.

It can be seen that the coldest winter temperatures occur in the Yukon and Tanana Valleys adjacent to the Canadian border. These areas also have the warmest July temperatures, indicating the continental nature of the climate there.

In contiguous United States and other north temperate areas, January temperatures are often used to delineate hardiness zones for perennial plants. However, in Alaska, because these areas of intense winter cold are also areas of maximum summer temperatures, this concept does not seem entirely valid. Whereas the cold winter temperatures may limit the distribution of some of the southern coastal plants into the interior, the cool summer temperatures in the western part of Alaska and the Aleutian Islands may be of equal or more significance in limiting the natural range or the introduction of some plants.

18. Thawing index. The thawing index map was published in "Environmental Atlas of Alaska" (Johnson and Hartman 1971, plate 42), scale 1:10,000,000, and was developed from the U.S. Weather Bureau (1965). Thawing index is the total number of degree-days above freezing during the year. It is an indication of both summer temperatures and duration. The thawing index varies from 5,000 degree-days in southeastern Alaska to only 500 degree-days in the extreme north. An area with a thawing index of less than the freezing index (General Map 19) is likely to have some permafrost.

Much of the State has a thawing index of 2,500 degree-days or more and supports forest vegetation except at high altitudes. The totals indicate that the higher summer temperatures in the interior compensate for the cooler but longer thawing seasons along the southern and southeastern coasts.

19. Freezing index. The freezing index map was published in "Environmental Atlas of Alaska" (Johnson and Hartman 1971, plate 45), scale 1:10,000,000, and was developed from the U.S. Weather Bureau (1965). Freezing index is the total number of degree-days below freezing during the year. In Alaska the freezing index varies from zero in the extreme southeast to 8,500 degree-days along the Arctic coast. The freezing index can be used to obtain an estimate of the depth of ground freezing during the winter, but the presence or absence of permafrost is related to both this and the thawing index (General Map 18).

20. Plant hardiness zones. A plant hardiness zone map for Alaska in color, scale about 1:13,000,000, has been compiled by Alan C. Epps (1973), of the University of Alaska. It is based on the average annual minimum temperature (i.e., the average of the lowest or extreme minimum temperature in each year) and also on the distribution of tundra vegetation.

On this map, reproduced here, the treeless areas where plant growth is severely restricted owing to extreme climatic conditions are not classified further. The remainder of Alaska is divided into six zones, based on increments of 10°F. for the average annual winter minimum temperature, as follows:

Zone 6, the mildest climate, limited to low elevation areas in southeastern Alaska, where the yearly minimum temperature averages between -10°F. and 0°F.

Zone 5, some interior parts of southeastern Alaska, borders of Prince William Sound, parts of Afognak and Kodiak Islands, and a few places in the Alaska Peninsula, where the yearly minimum temperature averages -10°F. to -20°F.

Zone 4, small interior parts of southeastern Alaska, small areas along the coast, parts of the Kenai Peninsula mostly near Homer, sections of the Alaska Peninsula, and the northern portions of Afognak and Kodiak Islands, where the annual minimum temperature averages -30°F. to -20°F.

Zone 3, primarily the northern Cook Inlet region, the Chitna Valley, and areas around Lake Clark and Dillingham, where the annual minimum temperature averages between -40°F. and -30°F.

Zones 1 and 2, the remainder of Alaska, from the Brooks Range south through most of the interior below the limit of trees, where annual minimum temperatures range from -70°F. to -40°F. Presumably this zone could be further subdivided into two or three subzones on the basis of the average annual minimum temperatures.

In the lower 48 States, hardiness zones based upon minimum winter temperatures indicate the range limits of many native trees and shrubs and the survival of introduced species. However, in Alaska, other factors, such as low or high summer temperatures, seem equally significant, as noted under mean minimum temperature (General Map 17) and as suggested by the thawing index (General Map 18).

21. Fire season climatic zones. The map of the "Fire Season Climatic Zones" of mainland Alaska is from that by Trigg (1971), of the U.S. Forest Service, published at a scale of approximately 1:12,000,000. It is based on C. W. Thornthwaite's Precipitation Effectiveness Index and Temperature Effectiveness Index, both of which integrate precipitation and temperature data from standard weather stations. The main purpose was to designate maximum and minimum fire danger areas in mainland Alaska during the wildfire season of April through September. This map is also useful in designating areas with similar climates during the growing season.

Sixteen possible climatic zones from hot and arid to cold and wet are listed in the table below.

Temperature Effectiveness Index Class	Precipitation Effectiveness Index Class			
	ARID	DRY	MOIST	WET
HOT	Hot-arid 1	Hot-dry 3	Hot-moist 6	Hot-wet 10
WARM	Warm-arid 2	Warm-dry 5	Warm-moist 9	Warm-wet 13
COOL	Cool-arid 4	Cool-dry 8	Cool-moist 12	Cool-wet 15
COLD	Cold-arid 7	Cold-dry 11	Cold-moist 14	Cold-wet 16

Twelve zones are distinguished in mainland Alaska. As would be expected, the cold-wet areas are along the south and southwest coast and correspond to the coastal forests. Southeastern Alaska is in the cold-wet zone also. The cold-moist and cold-dry areas are along the west and north coasts, and the hot-arid and hot-dry areas are in the eastern interior basins, primarily along the Tanana and Yukon Rivers and the Copper River Basin.

22. Vegetation of Alaska. A colored vegetation map was first prepared by Lloyd A. Spetzman (1963), of the U.S. Geological Survey, and published by the U.S. Army Office, Chief of Engineers (printed by Army Map Service), scale 1:2,500,000. This map was modified by the senior author and published in "Alaska Trees and Shrubs" (Viereck and Little 1972), scale 1:5,000,000. It has been further adapted for publication in this Atlas, scale 1:10,000,000. Also, treeless bogs and shrub thickets have been combined under other types and not shown separately.

Six vegetation types are distinguished, 3 of forests and shown also in "Forests of Alaska" (General Map 23) and 3 of tundra or treeless, as follows:

1. Sitka spruce-hemlock forests. Tall, dense coastal forests of Sitka spruce, western hemlock, locally with other conifers, and black cottonwood, often interspersed with open treeless bogs.

2. Closed spruce-hardwood forests. Tall to moderately tall closed forests of white and black spruce, paper birch, aspen, and balsam poplar; on moderate to well-drained sites.

3. Open, low-growing spruce forests and treeless bogs. Primarily of black spruce but often interspersed with white spruce, paper birch, tamarack, and willows, locally interspersed with treeless bogs; on poorly drained sites usually underlain by permafrost.

4. Moist tundra. Tundra meadows dominated by sedges, especially in tussocks. Also extensive areas of willow and alder thickets along streams and on protected slopes.

5. Wet tundra. Wet coastal tundra and marsh, predominantly sedges and grasses. Also extensive shrub thickets along streams.

6. Alpine tundra, ice and snow. Predominantly barren, alpine tundra dominated by white mountain-avens, low heath shrubs, prostrate willows, and dwarf herbs. Also extensive shrub thickets of resin birch, alder, and willows at lower elevations.

The second and third forest types in the interior together form the northern coniferous forest or taiga.

23. Forests of Alaska. The U.S. Forest Service has published maps of the forests. Taylor (1929) prepared a map of forest regions of Alaska in color in "Pocket Guide to Alaska Trees," scale 1:5,000,000, which in a later edition was reduced to scale 1:12,500,000. A revision in color appeared in "Alaska's Forest Resource" (Hutchison 1967), scale 1:5,500,000.

The map in this Atlas is slightly revised and adapted also from that of "Vegetation of Alaska" (General Map 22). However, forests are shown more clearly, because nonforested areas are unmapped. The following types are distinguished:

1. Sitka spruce-hemlock forests (coastal). Tall, dense coastal forests of western hemlock, Sitka spruce, locally with other conifers, and black cottonwood, often interspersed with open treeless bogs. These fast-growing forests are found along the Pacific coast from the extreme southeast to the west side of Cook Inlet and Afognak and Kodiak Islands. Commercial and of high economic importance.

2. Spruce-hardwood forests (interior). Tall to moderately tall closed forests (well stocked) of white and black spruce, paper birch, aspen, and balsam poplar; on moderate to well-drained sites. Commercial and capable of supporting a forest industry.

3. Open, low-growing spruce forests (interior). Primarily of black spruce but often interspersed with white spruce, paper birch, tamarack, and willows, locally interspersed with treeless bogs; on poorly drained sites usually underlain by permafrost. Open forests of slow growth (poor to medium stocked), generally classed as noncommercial at present.

4. Nonforest or treeless. Shrub thickets (willow, alder) along streams, bogs, tundra (moist, wet, and alpine), and ice and snow.

The two forest types of the interior together form the northern coniferous forest or taiga.

SPECIES MAPS AND RANGES

The natural distribution of each species within Alaska is shown on a map (Species Maps 1-82) and is stated below in words concisely for reference. A paragraph summarizes the range somewhat like a legend, because a map without accompanying text is incomplete. The descriptions have been revised slightly from those in "Alaska Trees and Shrubs" to agree with the new, larger maps.

Place names along the corners and borders of the range within Alaska are mentioned. General distribution beyond the State has been added, as in the earlier handbook. Most place names cited may be found on the two base maps of North America and Alaska (General Maps 1 and 2). The larger areas under management by the Federal Government where each species is known were listed in that handbook because of special interest to residents and visitors. These names of National Forests, National Parks, Wildlife Refuges, etc., have not been repeated here.

Numbers, common names, and scientific names of the 82 species of Alaska trees and common shrubs in the paragraphs of ranges below correspond to the species maps and the list of Species Maps under Contents (page iii). Botanical descriptions and drawings of each species, and also keys for identification, may be found in "Alaska Trees and Shrubs."

Size and general distribution are summarized by letters for reference, as in that handbook. Trees and shrubs are distinguished as follows: LT, large tree, more than 70 ft. (21 m.) high; MT, medium tree, 30-70 ft. (9-21 m.) high; ST, small tree, 12-30 ft. (4-9 m.) high; LS, large shrub, 6-20 ft. (2-6 m.) high; MS, medium shrub, 2-6 ft. (0.6-2 m.) high; SS, small or low shrub, 0-2 ft. (0-0.6 m.) high; and PS, prostrate or creeping shrub. General distribution is given as I, interior, and C, coastal, with small letter where restricted. The 10 tree species producing nearly all the commercial timber are indicated by an asterisk (*).

1. **Pacific yew, *Taxus brevifolia* Nutt.** (LS-ST, C). Rare and local in extreme southeast Alaska, only on a few islands near Ketchikan, including Annette, Dog, Cat, Mary, Bold, and Gravina Islands. Also southern part of Prince of Wales Island north to Hydaburg and to Kasaan Island in Kasaan Bay. Pacific coast region from southeast end of Alaska and British Columbia south through western Washington to central California and in mountains to Idaho and northwestern Montana.

2. **lodgepole pine, *Pinus contorta* Dougl.** (ST-LT, C). Southeast Alaska, central Yukon, and southwestern Mackenzie, south in mountains and along Pacific coast to Colorado, Utah, and California; also local in northern Baja California. Two varieties in Alaska listed below, not distinguished on map.

2a. shore pine, *Pinus contorta* Dougl. var. *contorta*. Through southeast Alaska from Portland Canal northwest to head of Lynn Canal at Haines and to Glacier Bay, Dixon Harbor, and Cape Fairweather. Also northwestern outlier 15 miles east of Yakutat. Pacific coast from southeast Alaska through western British Columbia to northwestern California.

2b. lodgepole pine, *Pinus contorta* var. *latifolia* Engelm. Only at northernmost end of southeast Alaska in vicinity of Skagway and Haines and Chilkoot River at head of Lynn Canal. Southeast Alaska northward in Yukon Territory and east to southwestern Mackenzie and south through western Alberta and British Columbia and in Rocky Mountains to Colorado and Utah.

3. **tamarack, *Larix laricina* (Du Roi) K. Koch** (ST-MT, I). Interior Alaska along Tanana River from east of Big Delta, Yukon River from isolated stations at Canadian border and Circle, and up Koyukuk River to Allakaket. West to Unalakleet River, which drains into Norton Sound, and south to Napaimiut on lower Kuskokwim River. From Alaska, Yukon Territory, and District of Mackenzie east across Canada along northern limit of trees to Hudson Bay, Labrador, and Newfoundland, south in Northeastern United States to New Jersey, Illinois, and Minnesota (local in Maryland and West Virginia), and northwest to northeastern British Columbia.

4. **black spruce, *Picea mariana* (Mill.) B.S.P.** (ST-MT, I). Interior Alaska within range of the spruce-hardwood forest and north to southern slopes of Brooks Range. West from Old Rampart to Wiseman, upper Kobuk River near Shungnak, also Squirrel River, to Kaltag on Yukon River and to Elim at base of Seward Peninsula. South to Stony River on Kuskokwim River, Lake Clark, and Iliamna, and reported from Naknek at base of Alaska Peninsula. South of Alaska Range in Susitna Valley, Cook Inlet and Kenai Peninsula to Homer and in Copper River Basin to Tonsina and McCarthy. From western interior Alaska east across Canada near northern limit of trees to Hudson Bay, Labrador, and Newfoundland, south to New Jersey, Minnesota, Manitoba, and British Columbia.

5. ***white spruce, *Picea glauca* (Moench) Voss** (MT-LT, I-c). Through interior Alaska corresponding to the range of the spruce-hardwood forest, north and west to tree limit. From Firth River and its tributary Joe Creek on Arctic slope, west along south slopes of Brooks Range from Arctic and Wiseman to Noatak River. South in eastern part of Seward Peninsula to Unalakleet, St. Marys on Yukon River, Bethel on Kuskokwim River, and Dillingham, and Naknek Lake near base of Alaska Peninsula. Also south of Alaska Range from Susitna Valley to Cook Inlet and northern Kenai Peninsula and east to McCarthy in Copper River

Basin. From northwestern Alaska east across Canada near northern limit of trees to Hudson Bay, Labrador, and Newfoundland, south to New York, Minnesota, Montana, and British Columbia, also local in Black Hills.

6. ***Sitka spruce, *Picea sitchensis* (Bong.) Carr.** (LT, C). Along Pacific coast of southeastern and southern Alaska corresponding to the range of the Sitka spruce-hemlock forest. Throughout southeast Alaska from Portland Canal northwest to head of Lynn Canal at Skagway, Glacier Bay, and Yakutat Bay. West along coast of southern Alaska to Prince William Sound, and Kenai Peninsula. Reported from the south slope of Mt. Susitna. From Tuxedni Bay on west side of Cook Inlet south along coast of base of Alaska Peninsula to Cape Kubagakli near southern boundary of Katmai National Monument. Also the only conifer on Afognak Island and northern Kodiak Island. From southern Alaska at Kodiak Island southeast along Pacific coast to northwestern California.

7. ***western hemlock, *Tsuga heterophylla* (Raf.) Sarg.** (LT, C). Along Pacific coast of southeast and southern Alaska corresponding to the range of the hemlock—Sitka spruce forest but not reaching Afognak and Kodiak Islands or the west side of Cook Inlet. Throughout southeast Alaska from Portland Canal northwest to head of Lynn Canal at Skagway, Glacier Bay, and Yakutat Bay, west to Prince William Sound and Portlock at southwest end of Kenai Peninsula. From southern Alaska southeast along Pacific coast to northwestern California and east in mountains to southeastern British Columbia, northwestern Montana, and northern Idaho.

8. ***mountain hemlock, *Tsuga mertensiana* (Bong.) Carr.** (ST-LT, C). Along Pacific coast of southeast and southern Alaska corresponding to the range of the hemlock—Sitka spruce forest but not reaching Afognak and Kodiak Islands. Throughout southeast Alaska from Portland Canal northwest to head of Lynn Canal at Skagway, Glacier Bay, and Yakutat Bay, west to Prince William Sound, vicinity of Anchorage, and Kenai Peninsula. Also local near Tyonek west of Cook Inlet and recorded from Lake Iliamna on Alaska Peninsula. From southern Alaska southeast along Pacific coast of British Columbia and in mountains to western Montana and central California.

9. **Pacific silver fir, *Abies amabilis* (Dougl.) Forbes** (MT-LT, C). Rare and local in extreme southeast Alaska in Ketchikan area, including George and Carroll Inlets and Thorne Arm on Revillagigedo Island. Also east and southeast on mainland near Smeaton Bay of Behm Canal, Marten Arm of Boca de Quadra, and Very Inlet. From extreme southeast Alaska south through Pacific coast region of British Columbia and in mountains to Oregon and northwestern California.

10. **subalpine fir, *Abies lasiocarpa* (Hook.) Nutt.** (ST-LT, C). Rare and local at both southern and northern ends of southeast Alaska. At southern end near Hyder, Harris Mountain near Hollis and Virginia Mountain near Calder on Prince of Wales Island, and Grace Mountain on Dall Island. At northern end in Taku River Valley northeast of Juneau and near Skagway at head of Lynn Canal. Reported westward from 3 localities in southern interior Alaska but without confirmation. Southeast Alaska, central Yukon Territory, and southwestern District of Mackenzie, south through British Columbia and southwestern Alberta and in mountains to New Mexico, Arizona, and northwestern California.

11. *western redcedar, *Thuja plicata* Donn (LT, C). Southern third of southeast Alaska from Portland Canal north to Hyder, Wrangell, southern Mitkof Island (south of Petersburg), Woewodski Island, Duncan Canal in southern Kupreanof Island, and southern Kuiu Island. Pacific coast region of southeast Alaska south to northwestern California, also east in Rocky Mountains to western Montana and southeastern British Columbia.

12. *Alaska-cedar, *Chamaecyparis nootkatensis* (D. Don) Spach (MT-LT, C). Through southeast Alaska from southern part of Portland Canal north to Berners Bay in Lynn Canal, also local near Haines, and west to Yakobi Island, Lituya Bay, and Yakutat. Also Prince William Sound from Cordova west to Glacier Island, Port Wells, and Latouche Island. Pacific coast from southern Alaska southeast through British Columbia and in mountains to Oregon and northwestern California.

13. common juniper, *Juniperus communis* L. (PS-SS, I-C). Through most of Alaska except extreme northwest and west, Alaska Peninsula, and Aleutian Islands. Scattered through southeast Alaska from Annette Island to Skagway and Lituya Bay. North in interior to Firth, Porcupine, Yukon, Koyukuk, Kobuk, and Noatak Rivers and north of Brooks Range to Canning, Shaviovik, and Chandler Rivers. West to Elim on Seward Peninsula and south to Takotna, and Nuyakuk Lake and other lakes north of Dillingham, and east to Iliamna, Kenai Peninsula, and Chitina River Valley. Alaska, east across Canada to Labrador, Newfoundland and Greenland, south mostly in mountains to Georgia, Illinois, New Mexico, and California. Also across northern Europe and Asia. Becomes a small tree rarely in New England and frequently in Europe. Including geographic varieties, this species is the most widely distributed conifer in the world and the most widespread tree species in the north temperate zone.

14. creeping juniper, *Juniperus horizontalis* Moench (PS, I). Rare and local in southeast interior Alaska along Chitina and Copper Rivers and west to Hicks Creek (east of Palmer). Southern Alaska, Yukon Territory, and Mackenzie, east to Great Slave Lake, Hudson Bay, Labrador, and Newfoundland, south to New York, Michigan, Iowa, and Colorado. This shrub rare in Alaska though widespread eastward is included here so that all 14 species of the State's native conifers will have detailed maps available together.

15. *balsam poplar, *Populus balsamifera* L. (MT-LT, I-c). Through interior Alaska corresponding to the range of the spruce-hardwood forest, north and west to tree limits and in scattered stands beyond. North on south slopes of Brooks Range in drainages of Porcupine, Koyukuk, Kobuk, and Noatak Rivers; north of Brooks Range in small isolated stands along many rivers draining into Arctic Ocean from Firth River westward but best developed and most extensive along Canning River. West to Igloo (northeast of Teller) near western tip of Seward Peninsula; south to Unalakleet, mouth of Yukon River at Alakanuk, reaching coast of Bristol Bay near Dillingham, on Alaska Peninsula at Katmai National Monument and southwest to Chignik, and on Kodiak Island. South of Alaska Range to Cook Inlet, Kenai Peninsula, and Copper River drainage. From northwest Alaska east across Canada to Labrador and Newfoundland, south in eastern United States to West Virginia, Indiana, and Iowa and in western mountains locally as far south as Colorado. Intergrades or hybridizes with the next species in southern Alaska where ranges of the two overlap.

16. *black cottonwood, *Populus trichocarpa* Torr. & Gray (LT, C). Pacific coast of southeast and southern Alaska corresponding to the range of the hemlock-Sitka spruce forest. Southeast Alaska from Hyder on Portland Canal and Wrangell northwest, mostly on mainland and uncommon on islands, more common from Stikine River northwest to Skagway at head of Lynn Canal, along the Dyea, Chilkat, and Klehini Rivers, Glacier Bay, and Yakutat, and west to Prince William Sound, Susitna Valley, Kenai Peninsula, and northern part of Kodiak Island. Southern Alaska and southern Yukon Territory south through British Columbia to Montana, Idaho, and California and in mountains to Utah and Baja California. Intergrades or hybridizes with the preceding species in southern Alaska where ranges of the two overlap. Regarded also as a variety or subspecies.

17. *quaking aspen, *Populus tremuloides* Michx. (ST-MT, I). Through interior Alaska within range of the spruce-hardwood forest but not as far north or west nor as high in mountains as white spruce. North to south slopes of Brooks Range, west to Koyukuk and Kobuk Rivers, and south on Yukon River to Holy Cross and on Kuskokwim to Bethel and to base of Alaska Peninsula at Lake Iliamna and Katmai National Monument. Also south of Alaska Range in Susitna Valley, Cook Inlet, Kenai Peninsula, and Copper River areas. Southeast Alaska only in extreme northern part near Haines and Skagway at head of Lynn Canal. Alaska east across Canada to Labrador and Newfoundland, south in Northeastern United States to New Jersey, Virginia, and Missouri, and south in western mountains to Trans-Pecos Texas, California, and Mexico. The most widely distributed tree species in North America.

18. feltleaf willow, *Salix alaxensis* (Anderss.) Cov. (LS-ST, I-C). Widely distributed and common almost throughout Alaska from southeast Alaska to Arctic Ocean. Southeast Alaska from Hyder to head of Lynn Canal but not on outer islands; north through interior to Arctic Coast and northwest to Cape Lisburne; west to Bering Sea except in a few isolated areas, St. Lawrence, St. Mathew, and Pribilof Islands; southwest on Alaska Peninsula and Aleutian Islands to Unalaska Island; and east to Kodiak Island, Cook Inlet, and Prince William Sound. Alaska east to northwest shore of Hudson Bay and south to central British Columbia, but not reaching contiguous United States. Also in eastern Asia.

19. littletree willow, *Salix arbusculoides* Anderss. (LS-ST, I-c). Widely distributed in Alaska from Copper River Basin northward nearly to Arctic Ocean on Sadlerochit River; west in scattered locations north of Brooks Range to Chukchi Sea at Kotzebue and to Bering Sea on Yukon and Kuskokwim deltas, with isolated localities on Seward Peninsula; south to south slopes of Alaska Range with isolated locations on Alaska and Kenai Peninsulas. Alaska east to Hudson Bay and south to British Columbia and central Quebec.

20. Barclay willow, *Salix barclayi* Anderss. (MS-ST, I-C). Common along southern coast of Alaska and reaching into the interior basin. From Hyder at southeastern end northward to Yakutat but not reaching outer islands, north to Tanana River with an isolated location at Bettles; west to central Kuskokwim River, with isolated localities at Norton Sound and Yukon Delta, and southwest to Unalaska in Aleutian Islands; and east to Kodiak Island, Kenai Peninsula, and Prince William Sound. From Alaska south along the coast to Washington and eastward to Alberta and Montana.

21. Bebb willow, *Salix bebbiana* Sarg. (LS-ST, I-C). Widely distributed in interior Alaska south to the Pacific coast. In northern part of southeastern Alaska at head of Lynn Canal. In central Alaska, primarily along the rivers from Prince William Sound to Porcupine River and with isolated occurrences at Wiseman and on Kobuk River; occasionally in western Alaska, on Yukon River to Holy Cross and on Kuskokwim River to Aniak; in southwestern Alaska from Dillingham southeast to Kodiak Island; in south-central Alaska to southern tip of Kenai Peninsula. Alaska, east across Canada to Hudson Bay, Labrador, and Newfoundland, and south to New Jersey, Nebraska, New Mexico, and central California. Also in eastern Asia.

22. grayleaf willow, *Salix glauca* L. (MS-ST, I-C). Throughout Alaska except Aleutian Islands and southeast coast. In southeast Alaska only at Glacier Bay and Haines-Skagway area. In mainland Alaska from Prince William Sound northward to Arctic Ocean near Barter Island but lacking in extreme northern portion of the coastal plain to the west; westward to Chukchi and Bering Seas except for some small areas on Seward Peninsula and Yukon-Kuskokwim Delta; southwest to end of Alaska Peninsula and one location at Adak Island in Aleutians; east to Kodiak Island and Kenai Peninsula. From Alaska east across Canada to Labrador and Newfoundland, south to southern British Columbia and in Rocky Mountains to northern New Mexico. Also northern Europe and Asia.

23. Hooker willow, *Salix hookeriana* Barratt (LS-ST, C). Coastal Alaska in vicinity of Yakutat and Dry Bay; also isolated occurrences on Prince William Sound and on Middleton Island. Pacific coast from southern Alaska and Queen Charlotte Islands (Moresby Island) and extreme southwestern British Columbia, Vancouver Island, and Puget Sound region of western Washington south to northwestern California. Reported also from eastern Siberia.

24. sandbar willow, *Salix interior* Rowlee (LS, I). Distribution limited along main rivers in interior Alaska. Along Yukon River and its tributaries from Canadian border westward to Galena and on Tanana River and its tributaries from Tok to its confluence with the Yukon. Two questionable localities are reported from Umiat and Anaktuvuk Pass. From Alaska east across Canada and south to Virginia, Louisiana, New Mexico, and northern Mexico.

25. Richardson willow, *Salix lanata* L. ssp. *richardsonii* (Hook.) A. Skwartz. (MS-ST, I-C). Through most of central and south-central Alaska north to Arctic Ocean. In southeastern Alaska only in mountains from Juneau to Haines and at Yakutat. In central Alaska from Copper River Basin northward to Arctic Ocean; westward to Chukchi and Bering Seas but not on oceanic islands; southward to mouth of Kuskokwim River, south slopes of Alaska Range, and Matanuska Valley, with isolated occurrences in Tikchik Lake, Naknek, and Unalaska Island in the Aleutians. This subspecies occurs across northern Canada to Baffin and Southampton Islands, south to northwestern Hudson Bay and British Columbia; also northeastern Asia. The species ranges across northern North America, Europe, and Asia and south in mountains of Asia.

26. Pacific willow, *Salix lasiandra* Benth. (LS-ST, I-c). Interior and southeast Alaska. In southeast Alaska at isolated localities at Hyder, Stikine River, head of Lynn Canal, Glacier Bay, and Yakutat. In central Alaska from Palmer north to the central Yukon River area with an isolated location at Wiseman;

west on Tanana River to Minto, with isolated occurrences on the lower Yukon and Kuskokwim Rivers; east to the Susitna Valley and Palmer. From Alaska east to Saskatchewan and south to New Mexico and southern California.

27. park willow, *Salix monticola* Bebb (MS-LS, I-c). Central interior Alaska along Yukon and Tanana Rivers and their tributaries. In southeastern Alaska only in Haines-Skagway area. From an isolated occurrence in Cordova north to the Yukon basin with one outlier on north slope of Brooks Range in Ikiak-paurak Valley of Canning River; west only to Rampart on Yukon River and Fairbanks on Tanana River, with a local population in the east end of Mount McKinley National Park; south to south slope of Alaska Range along the Anchorage-Fairbanks Highway and to Copper River Basin. From Alaska east to Hudson Bay and south to Ontario, Colorado, and Oregon.

28. tall blueberry willow, *Salix novae-angliae* Anderss. (LS-ST, I). Local along rivers in interior Alaska. From the Yukon River at Circle west only to Minto on Tanana River, with an outlier at Farewell on north side of Alaska Range; south to Matanuska Valley, and east to the Copper River Basin. From Alaska east to British Columbia and southward in mountains to southern Utah and northern California.

29. diamondleaf willow, *Salix planifolia* Pursh ssp. *pulchra* (Cham.) Argus (PS-ST, I-C). Almost all Alaska except the western Aleutians and the coastal forests of southeastern part. In southeast Alaska only at Juneau and Haines. From Prince William Sound northward to the Arctic Ocean; westward to the Chukchi and Bering Seas, including many island locations; southward to the eastern Aleutians, and east to Kodiak Island and Kenai Peninsula. Alaska east to Yukon Territory and south to British Columbia. In Asia from Novaya Zemlya to Chukchi Peninsula.

30. netleaf willow, *Salix reticulata* L. (PS, I-C). Widely scattered over most of the State but with wide gaps in the distribution. In southeast Alaska mostly in the northern part but with isolated localities on Coronation Island and at Yakutat. From Prince William Sound north to the Arctic Ocean but absent in the Yukon River lowlands; west to the Chukchi and Bering Seas but absent in several areas along and inland from Bering Sea; several locations on the Aleutians to the westernmost islands; on Kodiak and Afognak Islands but absent on most of Alaska Peninsula, the western Cook Inlet area, and Kenai Peninsula. From Alaska eastward across northern Canada to Great Slave Lake, northern Hudson Bay, and Newfoundland.

31. Scouler willow, *Salix scouleriana* Barratt (LS-MT, I-C). Through southeast Alaska north to Glacier Bay except possibly the outer islands. From Prince William Sound northward to the Tanana Valley with one outlier on Porcupine River near the Canadian border; west to isolated populations on Yukon River at Galena and Kuskokwim River at McGrath; south to isolated occurrences on the Alaska Peninsula and Kodiak Island, and east to Kenai Peninsula. From Alaska eastward to Saskatchewan and south to New Mexico and California.

32. Sitka willow, *Salix sitchensis* Sanson (LS-ST, I-C). Pacific coast region of southeast and southern Alaska. Throughout southeast Alaska from southern tip northward except the outer islands; westward along the coast to Prince William Sound, Kenai Peninsula, Kodiak Island, and Alaska Peninsula. Alaska and British Columbia south along the coast to southern California and east to New Mexico and Black Hills. Also in eastern Asia.

33. sweetgale, *Myrica gale* L. (SS-MS, I-C). Southeastern, south-central, and interior Alaska. Throughout lowlands of south-east except the outer islands; northwest along the coast to Prince William Sound; north only in lowlands along rivers to the Tanana and Yukon Rivers and to Wiseman in southern foothills of Brooks Range; west to isolated occurrences on Norton Sound and at McGrath on the Kuskokwim River; south to isolated localities at mouth of Kuskokwim River, head of Bristol Bay, and Alaska Peninsula; and east to Kodiak Island and Kenai Peninsula. From Alaska east across Canada to southern end of Hudson Bay, Labrador, and Newfoundland, south in mountains to North Carolina and Tennessee and to northwest Oregon. Also in northern Europe and eastern Asia and Japan.

34. dwarf arctic birch, *Betula nana* L. (SS-MS, I-c). Very widespread nearly throughout interior Alaska, north almost to Arctic Ocean, west to Bering Sea and western end of Alaska Peninsula. South of Alaska Range to Kodiak Island, Kenai Peninsula, and Copper River drainage. Also local in northern end of southeast Alaska at Yakutat and head of Lynn Canal at Haines and Skagway. Alaska, across northern Canada to Labrador and Greenland. Not in contiguous United States. Also across northern Eurasia.

35. resin birch, *Betula glandulosa* Michx. (SS-MS, I-c). Widely distributed in interior Alaska from Firth River, northern Brooks Range, and Noatak and Kobuk Rivers southward to Tanana, Farewell, northern Kenai Peninsula, and Copper River drainage. Also local near Haines at northern end of southeast Alaska. Alaska, across northern Canada to Labrador and Greenland, south in Northeastern United States to Maine, New York, Michigan, and Minnesota, and in western mountains to Colorado and California.

36. *paper birch, *Betula papyrifera* Marsh. (ST-LT, I-C). Through interior Alaska corresponding to the range of the spruce-hardwood forest but not quite so far north and west. North to south slopes of Brooks Range west to Kobuk River, also local on Noatak River, and to coast on south side of Seward Peninsula, south to Unalakleet, Marshall on Yukon River, Dillingham, Alaska Peninsula to Naknek Lake, and Afognak and Kodiak Islands. South of Alaska Range in Susitna Valley, Kenai Peninsula, and Copper River Valley. Also local in southeast Alaska at northeast end in vicinity of Lynn Canal from Skagway and Haines to Juneau and Taku River, also Tidal Inlet in Glacier Bay National Monument, and at southeast end at Hyder on Portland Canal. From northwest Alaska east across Canada to Labrador and Newfoundland, south in northeastern States to Pennsylvania and Iowa and in western States to Montana and northeastern Oregon (locally south to Nebraska and in mountains to North Carolina, South Dakota (Black Hills), and Colorado).

Paper birch is one of the most widespread tree species in northern North America and is composed of 6 or fewer intergrading geographical varieties. The 3 varieties in Alaska listed below are mapped together here but are further distinguished by key, description, drawing, and small map in "Alaska Trees and Shrubs." The last 2 intergrade or hybridize where their ranges meet and overlap.

36a. western paper birch, *Betula papyrifera* var. *commutata* (Reg.) Fern. Southeast Alaska and eastward.

36b. Alaska paper birch, *Betula papyrifera* var. *humilis* (Reg.) Fern. & Raup. Through most of interior Alaska and eastward.

36c. Kenai birch, *Betula papyrifera* var. *kenaica* (W. H. Evans) Henry. Southern part of interior Alaska from Cook Inlet, Kenai Peninsula area, and west to Kodiak Island and base of Alaska Peninsula. Known only from Alaska.

37. American green alder, *Alnus crispa* (Ait.) Pursh (MS-ST, I). Widely distributed in interior Alaska north to Colville River, north slopes of Brooks Range, Firth, Porcupine, Yukon, Koyukuk, Kobuk, and Noatak Rivers, and west to Bering Sea; south to Bethel and Alaska Range and southward in Susitna and Copper River Valleys, locally beyond. Alaska and Yukon Territory across Canada to Labrador, Newfoundland, and Greenland, south to New York, North Carolina (high mountains), Michigan, and Oregon. Also across northern Asia.

38. Sitka alder, *Alnus sinuata* (Reg.) Rydb. (LS-ST, I-C). Along Pacific coast of southeastern, southern, and southwestern Alaska. Through southeast Alaska from Portland Canal northeast to head of Lynn Canal at Skagway and to Yakutat; west along coast to Prince William Sound, Cook Inlet, Kenai Peninsula, Afognak and Kodiak Islands, and through Alaska Peninsula to Unimak Island in eastern Aleutians. Also northward in Susitna and Copper River Valleys and locally beyond. From southwestern Alaska along Pacific coast east to Yukon Territory, southeast to southwestern Alberta, western Montana, and northern California. Also in northeastern Asia. Intergrades with the preceding, American green alder (*Alnus crispa* (Ait.) Pursh), especially northward in interior, and often treated as a variety or subspecies of that species.

39. red alder, *Alnus rubra* Bong. (ST-MT, C). Through southeast Alaska from Portland Canal northwest to Skagway at head of Lynn Canal and to Yakutat. Pacific coast region from southeast Alaska southeast to southern California; also locally east to northern Idaho.

40. thinleaf alder, *Alnus tenuifolia* Nutt. (LS-ST, I-C). Interior Alaska from Yukon River Valley west to mouth of Yukon River, south to Bethel on Kuskokwim River, and base of Alaska Peninsula at Katmai, and east to Kenai Peninsula and Copper River Valley. Also north end of southeast Alaska from Juneau to Haines. Alaska and Yukon Territory southeast to southwestern Saskatchewan and south in mountains to New Mexico and California.

41. hemlock dwarf-mistletoe, *Arceuthobium tsugense* (Rosend.) G. N. Jones (Parasite, C). Generally distributed through coastal forests of southeast Alaska from south end of Portland Canal northwest to Haines near head of Lynn Canal and to Chichagof and Yakobi Islands. Southeast Alaska south in coastal forests to Oregon and to Sierra Nevada in central California.

42. stink currant, *Ribes bracteosum* Dougl. (MS-LS, C). Pacific coast from southeastern tip of Alaska northwest to Prince William Sound. From Alaska south along coast to northwestern California.

43. skunk currant, *Ribes glandulosum* Grauer (SS-MS, I). Of very erratic occurrence in south-central, interior, and southwestern Alaska. Scattered locations from near Valdez in Prince William Sound northward to Tanana River at Fairbanks and Manley Hot Springs and in Mt. McKinley National Park; several locations in Susitna Valley; southwestward to isolated localities on Stony River and in Dillingham area; and east to a location at Homer on Kenai Peninsula.

44. northern black currant, *Ribes hudsonianum* Richards. (PS-MS, I-C). Primarily in the interior forest area but with occasional locations in the coastal areas. In southeast Alaska at Hyder, Juneau, and the head of Lynn Canal; in central Alaska from the Copper River Basin northward to the south slopes of the Brooks Range; westward to a location in Noatak River Valley, Mountain Village on the Yukon River; south on Kuskokwim River nearly to Bethel, Wood River Lakes and Dillingham, and the head of Bristol Bay; and east to Seward on Kenai Peninsula. Alaska east to Hudson Bay, south to Minnesota, Utah, and Oregon.

45. swamp gooseberry, *Ribes lacustre* (Pers.) Poir. (MS, I-C). Southeastern, south-central, and interior Alaska. Southeastern Alaska from Ketchikan northward to head of Lynn Canal and Glacier Bay but not on outer islands. In interior Alaska from midway between Tok and Big Delta on Tanana River north to Circle Hot Springs, west to Manley Hot Springs, and south to Cantwell. South-central Alaska from Seward north to Matanuska Valley, also a small area in and adjacent to Katmai National Monument in southwestern part. Alaska, eastward to James Bay, southern Labrador, and Newfoundland, south to Pennsylvania, Tennessee, Minnesota, Colorado, and California. Also isolated locations in eastern Asia and northern Japan.

46. trailing black currant, *Ribes laxiflorum* Pursh (PS-MS, C). Southeastern and south-central Alaska. From southeastern end of Alaska north along coast to Prince William Sound and Kenai Peninsula; northward to Copper River Basin and in Susitna Valley to just north of Chulitna; also an isolated location at Lake Iliamna. From southern Alaska east to Alberta and south to Idaho and California.

47. American red currant, *Ribes triste* Pall. (PS-MS, I-C). Mostly within the interior forest of Alaska. Southeast Alaska only at head of Lynn Canal, also reported from vicinity of Icy Bay. From Prince William Sound northward to south slopes of Brooks Range and 2 locations beyond; westward to Noatak and Kobuk Rivers, Seward Peninsula, and inner edge of Yukon-Kuskokwim Delta; south to the Wood River Lakes—Dillingham area and Katmai National Monument; and east to Homer on Kenai Peninsula. Alaska east across Canada to Labrador and Newfoundland, south to West Virginia, Minnesota, South Dakota, and Oregon. Also in northeastern Asia.

48. western serviceberry, *Amelanchier alnifolia* (Nutt.) Nutt. (MS-ST, I-C). Southeast Alaska from southeast end north to Wrangell; northeast end from Taku River to Haines and Skagway at head of Lynn Canal; west in southern part from Cook Inlet area to Kenai Peninsula, and base of Alaska Peninsula to Katmai area and Wood River Lakes area north of Dillingham. Also interior along Chitina and Copper Rivers and along Tanana and central Yukon Rivers west to Galena. Alaska and Yukon Territory east to western Ontario and Minnesota, south to Iowa, Nebraska, Colorado, Utah, and northwestern California. This species, as mapped here, includes Pacific serviceberry, *Amelanchier florida* Lindl., which was accepted as distinct in "Alaska Trees and Shrubs."

49. Oregon crab apple, *Malus diversifolia* (Bong.) Roem. (ST, C). Pacific coast of southeast and southern Alaska, from Portland Canal northwest to Skagway at head of Lynn Canal, also at Yakutat and from Prince William Sound southwest to end of Kenai Peninsula. Southern Alaska southeast along Pacific coast to Washington, Oregon, and northwestern California.

50. bush cinquefoil, *Potentilla fruticosa* L. (SS-MS, I-c). Through interior Alaska except parts of southwest, western

Alaska Peninsula, and Aleutian Islands. Also northern end of southeast Alaska at Yakutat and Haines and Skagway. Alaska across Canada to Labrador, Newfoundland, and Greenland, south to New Jersey, Iowa, New Mexico, and California. Also across northern Eurasia.

51. prickly rose, *Rosa acicularis* Lindl. (SS-MS, I-c). Through interior Alaska north to south slope of Brooks Range, also northward at Sadlerochit Hot Springs and Umiat, west to Kobuk River and Seward Peninsula, south to Mountain Village on lower Yukon River, Bethel on Kuskokwim River, and Dillingham, and east to Kenai Peninsula and Chitina River. Also north end of southeast Alaska at Haines and Skagway and near Juneau. Alaska east across Canada to Labrador and Anticosti south to West Virginia, Minnesota, New Mexico, Idaho, and British Columbia. Also widespread across northern Eurasia.

52. Nootka rose, *Rosa nutkana* Presl (MS-LS, C). Pacific coast of southeastern and southern Alaska, through southeast from Portland Canal to Haines and Skagway at head of Lynn Canal, also Kenai Peninsula, Afognak and Kodiak Islands, and Unalaska in Aleutian Islands. Southeast along Pacific coast from Aleutian and Kodiak Islands of southern Alaska to northwestern California and inland in mountains to eastern Oregon, Utah, and Colorado.

53. American red raspberry, *Rubus idaeus* L. var. *strigosus* (Michx.) Maxim. (MS, I-C). Interior Alaska north to Porcupine and Yukon Rivers, west to Holy Cross and Mountain Village, south to Lake Aleknagik north of Dillingham, Iliamna Lake, Kenai Peninsula, and Chitina River Valley. Also along mainland of southeast Alaska from Haines and Skagway at head of Lynn Canal southeast to Portland Canal and Annette Island. Alaska across Canada to Newfoundland, south to North Carolina, Iowa, Arizona, California, and northern Mexico.

54. western thimbleberry, *Rubus parviflorus* Nutt. (MS, C). Through southeast Alaska from Portland Canal northwest to Lynn Canal at Haines and at Yakutat. Southeast Alaska east to Ontario and Minnesota, south in mountains to New Mexico, California, and northern Mexico.

55. salmonberry, *Rubus spectabilis* Pursh (MS-LS, C). Pacific coast of Alaska through southeast from Portland Canal northwest to Haines at head of Lynn Canal and to Yakutat and west along southern coast from Prince William Sound and Kenai Peninsula to Afognak and Kodiak Islands. Alaska Peninsula, and eastern Aleutian Islands. Southern Alaska southeast to northwestern California. Also a variety in Japan.

56. Greene mountain-ash, *Sorbus scopulina* Greene (MS-ST, I-C). Scattered through central interior Alaska from central Yukon River west to Golovin on Bering Sea, south to Aniak, Dillingham, and Katmai, and east to Kenai Peninsula, Susitna Valley, and Copper River Valley. Also scattered through southeast from Skagway and Haines at head of Lynn Canal southeast to Portland Canal. Alaska and British Columbia south-east to Alberta, South Dakota, New Mexico, and California.

57. Sitka mountain-ash, *Sorbus sitchensis* Roem. (MS-ST, C). Pacific coast of southeast and southern Alaska, from Portland Canal northwest to head of Lynn Canal at Skagway, and Glacier Bay, west along coast to Yakutat, Prince William Sound, Kenai Peninsula, Katmai area at base of Alaska Peninsula, and Afognak and Kodiak Islands. Southern Alaska southeast along coast to southern British Columbia and in mountains to Washington, central California, Nevada, and northwestern Montana. Reported from Yukon Territory.

58. **Beauverd spirea**, *Spiraea beauverdiana* Schneid. (SS, I-C). Almost throughout interior Alaska except extreme north and Aleutian Islands. Also northern end of southeast Alaska from Haines and Skagway to Juneau. Alaska, Yukon Territory, District of Mackenzie, also northeastern Asia.

59. **Douglas-maple**, *Acer glabrum* Torr. var. *douglasii* (Hook.) Dipp. (MS-ST, C). Southeast Alaska from Portland Canal and Prince of Wales Island northwest to Admiralty Island and Haines and Skagway at head of Lynn Canal. Southeast Alaska, southeast to western and southern British Columbia, southern Alberta, western Montana, and northwestern Wyoming, and west to Idaho, Washington, and Oregon. Rocky Mountain maple (*Acer glabrum* Torr., including this and other varieties) extends southward to northwestern Nebraska and in mountains to southern New Mexico and southern California.

60. **silverberry**, *Elaeagnus commutata* Bernh. (MS-LS, I). Scattered in central interior Alaska, especially along rivers, from Porcupine and Yukon Rivers to Tanana, west to upper Kuskokwim River near McGrath, and east to lower Susitna and Matanuska Rivers and to Copper and Chitina Rivers. Alaska and Yukon Territory east to Great Slave Lake, James Bay, and Gaspé Peninsula, south to Minnesota, South Dakota, Colorado, and Utah.

61. **buffaloberry**, *Shepherdia canadensis* (L.) Nutt. (MS, I-c). Eastern interior Alaska north to Firth River and north slope of Brooks Range, west to Kobuk and Noatak Rivers and Chukchi Sea coast near Kotzebue, south to Tanana, Farewell, and Kenai Peninsula, and east to Copper and Chitina River Valleys. Also northern end of southeast Alaska at Skagway and Haines, Glacier Bay National Monument, and northern Chichagof Island. From Alaska and Yukon Territory east to Great Bear Lake, James Bay, and Newfoundland, south in mountains to Maine, New York, Michigan, New Mexico, and Oregon.

62. **devilsclub**, *Oplopanax horridus* (Sm.) Miq. (MS-LS, I-C). Pacific coast of southeast and southern Alaska, through southeast from Portland Canal to Skagway at head of Lynn Canal and west to Prince William Sound, Kenai Peninsula, west side of Cook Inlet, and Afognak and Kodiak Islands. Southern Alaska southeast to Manitoba, Montana, Idaho, and southern Oregon; also local in Isle Royale, Michigan, and Ontario. A closely related species or variety is found in Japan.

63. **red-osier dogwood**, *Cornus stolonifera* Michx. (MS-LS, I-C). Central interior Alaska north to Porcupine and Yukon Rivers, west to Koyukuk and Anvik, and south to Stony River, Anchorage area, and Copper River Valley. Also through southeast Alaska from Skagway at head of Lynn Canal to Portland Canal, but not recorded from Chichagof and Baranof Islands. Alaska and Yukon Territory east to Labrador and Newfoundland, south in the east to Virginia and Kansas and in the west to New Mexico, California, and northern Mexico.

64. **crowberry**, *Empetrum nigrum* L. (PS, I-C). Almost throughout Alaska including Aleutian Islands, except areas of perpetual ice and snow and possibly extreme southeast along Portland Canal. Alaska east across northern Canada to northern Greenland, south to Labrador and Newfoundland, and south along coast and in high mountains to Maine, New York, Michigan, and California. Also widespread across Eurasia.

65. **bog-rosemary**, *Andromeda polifolia* L. (PS-MS, I-C). Throughout Alaska except extreme north and Aleutian Islands. From southern end of southeast Alaska northward to Yakutat with a possible gap along coast to Prince William Sound; northward to Canning and Colville Rivers within a few miles of Arctic Ocean; westward to Cape Lisburne on Chukchi Sea, western tip of Seward Peninsula and islands in Bering Sea; south to Unimak Island on Aleutians; and east to Kodiak Island and Kenai Peninsula. Alaska east across Canada to northern Labrador and south Greenland, south to New Jersey, Minnesota, and Washington. Northern Europe and Asia.

66. **bearberry**, *Arctostaphylos uva-ursi* (L.) Spreng. (PS, I-C). Common in interior forest region of Alaska and occasional in northern and northwestern parts, Alaska Peninsula, Aleutians, and southeast. In southeast Alaska at Hyder, on Coronation Island, and the Glacier Bay, Juneau, and Lynn Canal area, with a gap along the coast to Prince William Sound; northward to Brooks Range and occasional isolated localities on north side; westward spotty in Noatak and Kobuk River drainages and Seward Peninsula and along Yukon River to Galena; southwestward to isolated localities on Kuskokwim River, head of Bristol Bay, Alaska Peninsula, and eastern Aleutian Islands; and east to Kodiak Island and Kenai Peninsula. Alaska to Newfoundland, south in mountains to Georgia and California. Also in northern Europe and Asia.

67. **leatherleaf**, *Chamaedaphne calyculata* (L.) Moench (PS-SS, I). Lowlands of central Alaska and isolated localities to north and west. From Copper River Basin north to Porcupine River and local on north slope of Brooks Range; westward to Galena on Yukon River, scattered on Kobuk and Noatak Rivers, and at Nome; southwest to mouth of Kuskokwim River and an area at head of Bristol Bay; and east to Anchorage but not on Kenai Peninsula. From Alaska eastward to southern Hudson Bay and Newfoundland, south to Georgia, Minnesota, and northern British Columbia. Northern Europe and Asia.

68. **copperbush**, *Cladthamnus pyrolaeiflorus* Bong. (MS, C). Coastal southeast and south-central Alaska. From extreme southeastern tip of Alaska northward to Glacier Bay; also from Cordova on Prince William Sound west to Anchorage. Coastal Alaska south to northwestern Oregon.

69. **salal**, *Gaultheria shallon* Pursh (MS, C). Outer coastal area of extreme southeastern Alaska. Primarily on Prince of Wales, Revillagigedo, and Annette Islands, also an isolated location on Baranof Island. From southeastern Alaska south along coast to California.

70. **bog kalmia**, *Kalmia polifolia* Wang. (SS, C). Coastal areas of southeastern Alaska north to Lynn Canal and Cape Fairweather. From Alaska east to Hudson Bay and Newfoundland, south to New Jersey, Minnesota, and California.

71. **narrow-leaf Labrador-tea**, *Ledum decumbens* (Ait.) Lodd. (SS, I-C). Most of Alaska except southeastern part and Aleutian Islands. Local at head of Lynn Canal in northern part of southeast Alaska. From Prince William Sound northward to Arctic Ocean; west to islands of Bering Sea; southwest to Unimak Island in eastern Aleutians; and east to Kodiak Island and Kenai Peninsula. From Alaska east across the Canadian Arctic to Greenland and south to Labrador, Hudson Bay, and Lake Athabaska District. Also in northern Europe and Asia.

72. Labrador-tea, *Ledum groenlandicum* Oeder (MS, I-C). Southeast and interior Alaska. Coastal areas of southeast Alaska from southern tip north to head of Lynn Canal and Glacier Bay. Central Alaska from Copper River Basin north to south slopes of Brooks Range; west to Hughes on Koyukuk River; south to McGrath area of Kuskokwim River; and east to northern part of Kenai Peninsula. Alaska east across Canada to Newfoundland and Greenland, south to New Jersey, Ohio, Minnesota, and Washington.

73. rusty menziesia, *Menziesia ferruginea* Sm. (LS, i-C). Southeastern and south-central Alaska. Pacific coast of Alaska from extreme southeast end northwest to Kenai Peninsula; north to Curry in Susitna Valley, also 2 isolated localities west of Cook Inlet. Coastal Alaska south to northern California and eastward to eastern Washington.

74. Lapland rosebay, *Rhododendron lapponicum* (L.) Wahlenb. (PS-SS, I). Central, northern, and northwestern Alaska. From Copper River Basin at Copper Center north to outer northern foothills of Brooks Range but not in extreme north Arctic coastal plain; scattered west to Chukchi Sea; south in Noatak and Kobuk drainages and on Seward Peninsula; southwest along north slope of Alaska Range to headwaters of Stony River; and east to an isolated locality just north of Palmer. Alaska eastward across the Canadian Arctic to Ellesmere Island, Baffin Island, and Labrador, south in mountains to New York and British Columbia. Also in northern Europe and Asia.

75. Alaska blueberry, *Vaccinium alaskaense* Howell (MS, C). Coastal Alaska from southeastern tip northwest to western side of Prince William Sound. From Alaska south along Pacific coast to northern Oregon.

76. dwarf blueberry, *Vaccinium caespitosum* Michx. (PS-SS, i-C). Southeastern and southcentral Alaska. From extreme southeastern end of Alaska northward to Dry Bay, with a gap to Cordova in Prince William Sound; north to 2 isolated occurrences in Copper River Basin and Alaska Range; westward on south slopes of Alaska Range in Susitna drainage; also at Kenai on Kenai Peninsula. From Alaska east to Newfoundland and south in mountains to New England, New York, Minnesota, Colorado, and California.

77. early blueberry, *Vaccinium ovalifolium* Sm. (MS, i-C). Southeastern, south-central, and southwestern Alaska. From the extreme southeastern tip of Alaska northward along Pacific coast to Prince William Sound; north in south-central Alaska to south slopes of Alaska Range in Susitna River Valley; west to isolated localities at Bethel, Platinum, and Wood River—Tikchik Lakes area; southwest on the Aleutians but absent between Unalaska and Attu Islands; and east to Kodiak Island and Kenai Peninsula.

78. red huckleberry, *Vaccinium parvifolium* Sm. (MS-LS, C). Southeastern Alaska from southern tip northward to Lituya Bay, also an isolated locality at Yakutat. From southeast Alaska south along coast to central California.

79. bog blueberry, *Vaccinium uliginosum* L. (PS-SS, I-C). Throughout Alaska including Aleutian Islands except extreme northern Arctic coastal plain and some isolated areas along the west coast. Alaska, across Canada to Labrador and Greenland, south to New England, New York, and Minnesota. Also across Europe and Asia.

80. mountain-cranberry, *Vaccinium vitis-idaea* L. (PS, I-C). Throughout Alaska including Aleutian Islands. Alaska eastward across the Canadian Arctic to Baffin Island and western Greenland, south to Massachusetts, Great Lakes, and Vancouver Island. Also in northern Europe and Asia.

81. Pacific red elder, *Sambucus callicarpa* Greene (LS-ST, C). Pacific coast of southeast, southern, and southwest Alaska. Through southeast from Portland Canal northwest to Skagway at head of Lynn Canal, Yakutat, and west to Prince William Sound, Kenai Peninsula. Afognak and Kodiak Islands, Iliamna Lake, Dillingham, and coast at Platinum. Also through Alaska Peninsula to Unimak Island in eastern Aleutians. Pacific coast from southwest Alaska southeast to western Oregon and mountains of central and southern California.

82. high bushcranberry, *Viburnum edule* (Michx.) Raf. (MS-LS, I-C). Through most of interior Alaska except far north and west, western Alaska Peninsula, and Aleutian Islands. At Sadlerochit and Shublik Springs near Arctic Ocean in north-east. From Porcupine River and south slope of Brooks Range west to Kobuk and Noatak River Valleys and Nome, south to Russian Mission on Yukon River, Bethel, head of Bristol Bay. eastern Alaska Peninsula, and Afognak and Kodiak Islands. East from Kenai Peninsula along Pacific coast and through southeast from Skagway at head of Lynn Canal to Portland Canal. Alaska and Yukon Territory east to mouth of Mackenzie River. Great Bear Lake, Hudson Bay, Ungava Bay, and Newfoundland. south to Pennsylvania, Michigan, Minnesota, Colorado, and Oregon.

NOTES ON RANGES

Some observations on tree distribution may be noted from the maps of the 82 species. However, analyses of the ranges are outside the scope of this Atlas. As in the first volume, an attempt has been made to record where each species grows naturally now, not to explain or speculate how and why. Additional information on geographic distribution is summarized in "Alaska Trees and Shrubs."

The woody-plant species of Alaska generally can be separated into two groups according to distribution within the State corresponding to forest regions, as indicated in the List of Maps under Contents. Many are confined to the Sitka spruce-hemlock forests (C) of the Pacific coast in southeast and southern Alaska. The map of Sitka spruce (*Picea sitchensis*) locates the occurrence of the coastal forests. Other species are characteristic of the spruce-hardwood forests of the interior (I) or the tundra beyond. The map of white spruce (*Picea glauca*) shows the maximum extent of the interior forests. However, some species are found in both regions or extend a short distance into the other. Of the 32 species of trees native in Alaska, 20 are confined to the coastal region, several to the southern end. The other 12 are found in the interior, but 10 of these also range southward to the Pacific coast.

All tree species native in Alaska reach their northern limit somewhere in the State. Very few extend to the tree line and form the northern limit of trees. Examples are white spruce (*Picea glauca*), balsam poplar (*Populus balsamifera*), and feltleaf willow (*Salix alaxensis*), which goes even farther north as a shrub. Also, the tree species have an altitudinal limit up to a similar timberline on high mountains. Most shrub species have corresponding boundaries, but a few alpine shrubs go beyond through the alpine zone to perpetual ice and snow of the ice caps and glaciers.

Seven tree species are widespread in the interior or northern coniferous forests from Alaska across Canada to Labrador, Newfoundland, and the northeastern contiguous United States: tamarack (*Larix laricina*), white spruce (*Picea glauca*), black spruce (*Picea mariana*), paper birch (*Betula papyrifera*), balsam poplar (*Populus balsamifera*), quaking aspen (*Populus tremuloides*), and Bebb willow (*Salix bebbiana*).

A few species of low shrubs are almost everywhere or cosmopolitan having ranges nearly throughout the interior and southeast except on areas covered by perpetual ice and snow. Examples are crowberry (*Empetrum nigrum*), bog blueberry (*Vaccinium uliginosum*), mountain-cranberry (*Vaccinium vitis-idaea*), and netleaf willow (*Salix reticulata*).

Many species of Alaska's arctic shrubs are widely distributed in far northern regions around the globe, or circumpolar, across Canada, Europe, and Asia to Siberia. Others extend just to northern Europe or to Siberia. Some, known as arctic-alpine species, occur southward above the timberline in the alpine zone of the Rocky Mountains and high peaks of New England.

As shown on the maps, a few tree species are rare and local at their northern limits in southeastern Alaska. However, all extend southeast into some of the lower 48 States and are not endangered. Examples are Pacific yew (*Taxus brevifolia*), Pacific silver fir (*Abies amabilis*), subalpine fir (*Abies lasiocarpa*), and Hooker willow (*Salix hookeriana*).

APPLICATIONS OF THE MAPS

Several applications of these maps of Alaska trees and common shrubs may be mentioned, though most uses are obvious and have been noted in Volume 1. First, the maps show where each species grows wild and can be found for study for any purposes. Also, where plantations or plants from locally collected seed should be successful.

It is hoped that the maps will be useful in land-use planning in the 49th State. Some native species may be plant indicators whose presence may indicate or show certain combinations or tolerances of climate or soil conditions, or the suitability for agricultural crops or other uses. Maps have economic values, suggesting possible sources of wood and other products in addition to the detailed information on timber volumes provided by forest surveys.

The maps may arouse interest in their improvement and encourage further botanical exploration in Alaska to fill the gaps in records. To specialists, the maps may reveal errors and suggest corrections, also likely localities where further field work is needed for revision and where range extensions and State records may be sought. The natural ranges are preserved for the historical record, before the forests and other vegetation types are destroyed or changed, for example, by plantations and settlements.

The general maps and the species maps together summarize graphically the average and extreme conditions of the environment (temperature, precipitation, latitude, altitude, etc.) of each species. They provide the basis for correlation studies of distri-

bution of a species and the environment, including limiting factors. Also, there may be indicated local climates to which geographical or local races may be adapted.

In the collection of seed, maps can be useful. They show where seed can be collected from wild plants and suggest the possible occurrence of geographic races and seed sources, especially in far northern regions. Examples are tree improvement programs and testing or introduction beyond the native range, such as in foreign countries with similar climates.

Maps can be helpful in identifying wild trees and shrubs, indicating the presence or absence of a species in a particular area. Finally, the maps serve as background material for such studies as classification, evolution, paleobotany, and genetics.

There is still much to be learned about tree and shrub distribution in Alaska. The earlier request for additional data, particularly regarding the ranges of trees and shrubs, is repeated here. This information can be sent to the Institute of Northern Forestry, USDA Forest Service, Fairbanks, Alaska 99701.

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SELECTED REFERENCES

- Alaska Rural Development Council.
1974. Alaska's agricultural potential. Alaska Rural Dev. Counc. Publ. No. 1, 151 p. Univ. Alaska Coop. Ext. Serv.
- Anderson, H. E.
1953. Range of western redcedar (*Thuja plicata*) in Alaska. USDA Forest Serv. Alaska Forest Res. Cent. Tech. Note 22, 1 p. and map.
- Anderson, H. E.
1959. Silvical characteristics of Alaska-cedar (*Chamaecyparis nootkatensis*). USDA Forest Serv. Alaska Forest Res. Cent. Stn. Pap. 11, 10 p.
- Anderson, J. P.
1959. Flora of Alaska and adjacent parts of Canada. 543 p. Ames, Iowa: Iowa State Univ. Press.
- Argus, George W.
1973. The genus *Salix* in Alaska and the Yukon. Natl. Mus. Can. Publ. Bot. No. 2, 270 p.
- Britton, M. E.
1958. Vegetation of the arctic tundra. 18th Annu. Biol. Colloq. Oreg. State Coll. p. 26-61.
- Buckley, John L., and Libby, Wilbur L.
1959. The distribution in Alaska of plant and animal life available for survival. Arct. Aeromed. Lab. Tech. Rep. 58-10, 43 p.
- Burns, John J.
1964. Pingos in the Yukon-Kuskokwim Delta, Alaska: Their plant succession and use by mink. Arctic 17: 203-210.
- Cahalane, Victor H.
1959. A biological survey of Katmai National Monument. Smithsonian Misc. Collect. 138(5), 246 p.
- Calder, James A., Taylor, Roy L., and Mulligan, Gerald A.
1968. Flora of the Queen Charlotte Islands. Can. Dep. Agric. Res. Monogr. 4, Parts 1-2.
- Churchill, E. D.
1955. Phytosociological and environmental characteristics of plant communities in the Umiat region of Alaska. Ecology 36: 606-627.
- Cooper, W. S.
1924. The forests of Glacier Bay (Alaska), present, past, and yet unborn. J. For. 22: 16-23.
- Cooper, W. S.
1930. The seed plants and ferns of the Glacier Bay National Monument, Alaska. Bull. Torrey Bot. Club 57: 327-338.
- Cooper, W. S.
1939. Additions to the flora of Glacier Bay National Monument, Alaska, 1935-36. Bull. Torrey Bot. Club 66: 453-456.
- Cooper, W. S.
1942. Vegetation of the Prince William Sound Region, Alaska; with a brief excursion into post-Pleistocene climatic history. Ecol. Monogr. 12: 1-22.
- Coulter, H. W., Hopkins, D. M., Karlstrom, T. N. V., Péwé, T. L., Wahrhaftig, Clyde, and Williams, J. R.
1965. Map showing extent of glaciations in Alaska. Compiled by the Alaska Glacial Map Committee of the U. S. Geological Survey. U.S. Geol. Surv. Misc. Geol. Invest. Map I-415.
- Coville, F. V.
1900. The tree willows of Alaska. Proc. Wash. Acad. Sci. 2: 275-286.
- Coville, F. V.
1901. The willows of Alaska. Proc. Wash. Acad. Sci. 3: 297-362.
- Coville, F. V., and Funston, F.
1895. Botany of Yakutat Bay, Alaska, with a field report by F. Funston. Contrib. U.S. Natl. Herh. 3: 325-350.
- Daubenmire, R. F.
1968. Some geographic variations in *Picea sitchensis* and their ecological interpretation. Can. J. Bot. 46: 787-798.
- Drew, J. V., and Shanks, R. E.
1965. Landscape relationships of soils and vegetation in forest-tundra ecotone, Upper Firth River Valley, Alaska-Canada. Ecol. Monogr. 35: 285-306.
- Drury, William H., Jr.
1956. Bog flats and physiographic processes in the upper Kuskokwim River regions, Alaska. Contrib. Gray Herb. Harv. Univ. 178, 130 p.
- Dugle, Janet R.
1966. A taxonomic study of western Canadian species in the genus *Betula*. Can. J. Bot. 44: 929-1007.
- Eastwood, Alice.
1947. A collection of plants from the Aleutian Islands. Leaflet West. Bot. 5: 9-13.
- Eastwood, Alice.
1957. A list of plants from Dall and Annette Islands, Alaska. Leaflet West. Bot. 7: 102.
- Eliot, Willard Ayres, and McLean, G. B.
1938. Forest trees of the Pacific coast. 565 p. New York.
- Epps, Alan C.
1973. Plant hardiness zones of Alaska. Univ. Alaska. Coop. Ext. Serv. [map in colors]
- Ferrians, Oscar J., Jr.
1965. Permafrost map of Alaska. U.S. Geol. Surv. Misc. Geol. Invest. Map I-415.
- Faulner, Alvin J., Childers, Joseph M., and Norman, Vernon W.
1971. Water resources of Alaska. U.S. Geol. Serv., Water Resource Div. Open file rep., 60 p.
- Fowells, H. A., compiler.
1965. Silvics of forest trees of the United States. U.S. Dep. Agric., Agric. Handb. 271, 762 p.
- Gjaervoll, O.
1958-67. Botanical investigations in central Alaska, especially in the White Mountains. Parts I-III. K. Nør. Vidensk. Selsk. Skr. (Trondheim) 5, 74 p.; 4, 115 p.; 10, 63 p.
- Griggs, R. F.
1914. Observations on the edge of the forest in the Kodiak region of Alaska. Bull. Torrey Bot. Club 41: 381-385.
- Griggs, R. F.
1934. The edge of forest in Alaska and the reasons for its position. Ecology 15:80-96.
- Griggs, R. F.
1936. The vegetation of the Katmai district. Ecology 17: 380-417.
- Harris, Arland S.
1964. Sitka spruce; Alaska's new State tree. Am. Forests 70(8): 33-35.
- Harris, Arland S.
1965. Subalpine fir on Harris Ridge near Hollis, Prince of Wales Island, Alaska. Northwest Sci. 39: 123-128.
- Harris, Arland S.
1969. Alaska cedar. a bibliography with abstracts. USDA Forest Serv. Res. Pap. PNW-73, 47 p.
- Harris, Arland S.
1970. The loners of Alaska. Am. Forests 76(5): 20-22, 55-56.
- Heusser, C. J.
1954a. Alpine fir at Taku Glacier with notes on its postglacial migration to the Territory. Bull. Torrey Bot. Club 81: 83-86.
- Heusser, C. J.
1954b. Nunatak flora of the Juneau Ice Field, Alaska. Bull. Torrey Bot. Club 81: 236-250.
- Heusser, C. J.
1960. Late Pleistocene environments of Pacific North America. 308 p. New York: Am. Geogr. Soc.
- Hitchcock, C. Leo, Cronquist, Arthur, Ownbey, Marion, and Thompson, J. W.
1955-69. Vascular plants of the Pacific Northwest. 5 parts. Seattle and London: Univ. Wash. Press.
- Hosie, R. C.
1969. Native trees of Canada. Ed. 7, 380 p. Can. For. Serv. Dep. Fish. For. Ottawa.
- Hultén, Eric.
1936. New or notable species from Alaska. Contributions for the flora of Alaska I. Sven. Bot. Tidskr. 30: 515-528.
- Hultén, Eric.
1937. Flora of the Aleutian Islands. 397 p. Stockholm.
- Hultén, Eric.
1940a. History of botanical exploration in Alaska and Yukon Territories from the time of their discovery to 1940. Bot. Not. 1940: 289-346.

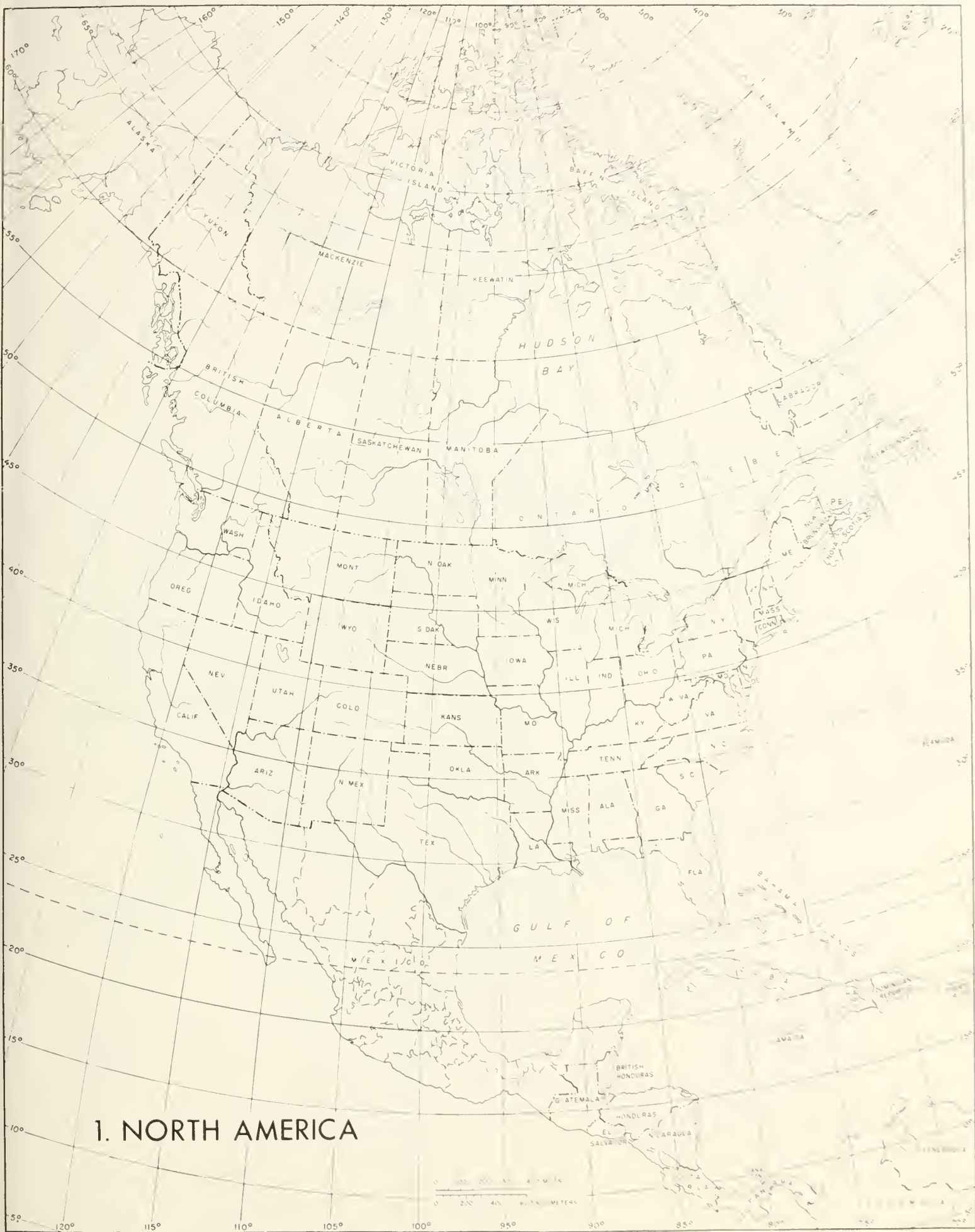
- Hultén, Eric.
1940b. Two new species of *Salix* from Alaska. *Sven. Bot. Tidskr.* 34: 373-376.
- Hultén, Eric.
1951-50. Flora of Alaska and Yukon, 1-10. *Lunds Univ. Arsskr., N. F., Avd. 2*, vol. 37-46, 1902 p.
- Hultén, Eric.
1960a. Contribution to the knowledge of flora and vegetation of the southwestern Alaska mainland. *Sven. Bot. Tidskr.* 60: 177-189.
- Hultén, Eric.
1960b. Flora of the Aleutian Islands. Ed. 2, 376 p. Weinheim/Bergstr.
- Hultén, Eric.
1962a. Flora and vegetation of Scammon Bay, Bering Sea Coast, Alaska. *Sven. Bot. Tidskr.* 56: 36-54.
- Hultén, Eric.
1962b. The circumpolar plants. I. Vascular cryptogams, conifers, monocotyledons. *Sven. Vetenskapsakad. Handl.* 8(5), 275 p.
- Hultén, Eric.
1967. Comments on the flora of Alaska and Yukon. *Sven. Vetenskapsakad. Handl. Ser.* 2, 7(1), 147 p.
- Hultén, Eric.
1968. Flora of Alaska and neighboring territories; a manual of the vascular plants. 1008 p. Stanford, Calif.: Stanford Univ. Press.
- Hultén, Eric.
1973. Supplement to the Flora of Alaska and Neighboring Territories: A study in the flora of Alaska and the Transberingian connection. *Bot. Not.* 126: 459-512.
- Hutchison, O. Keith.
1967. Alaska's forest resource. USDA Forest Serv. Res. Bull. PNW-19, 74 p.
- Johnson, A. W., Viereck, Leslie A., Johnson, E. R., and Melchior, H.
1966. Vegetation and flora. p. 277-354. In Wilomovsky, N. J., and Wolfe, J. N., eds. *Environment of the Cape Thompson region, Alaska*. U.S.A. Div. Tech. Inf. 1250 p.
- Johnson, Philip R., and Hartman, Charles W.
1971. Environmental atlas of Alaska. Ed. 2, 111 p., maps. Univ. Alaska, Inst. Arct. Environ. Eng., Inst. Water Resour.
- Johnson, Phillip, and Vogel, Theodore C.
1966. Vegetation of the Yukon Flats region, Alaska. U.S. Army Cold Reg. Res. Eng. Lab., Hanover, N.H., Res. Rep. 209, 53 p.
- Joint Federal-State Land Use Planning Commission for Alaska.
1973. Major ecosystems of Alaska. U.S. Geol. Surv. Fairbanks, Alaska, Denver, Colo., Wash., D. C. [folded maps in colors]
- Jones, George Neville.
1939. A synopsis of the North American species of *Sorbus*. *J. Arnold Arbor.* 20: 1-43.
- Jones, George Neville.
1946. American species of *Amelanchier*. Ill. *Biol. Monogr.* 20(2), 126 p.
- Jordal, L. H.
1951. Plants from the vicinity of Fairbanks, Alaska. *Rhodora* 53: 156-159.
- Jordal, L. H.
1952. Some new entities in the flora of the Brooks Range region, Alaska. *Rhodora* 54: 35-39.
- Lepage, Ernest.
1951. New and noteworthy plants in the flora of Alaska. *Am. Midl. Nat.* 46: 574-759.
- Little, Elbert L., Jr.
1951. Mapping ranges of the trees of the United States. *Rhodora* 53: 195-203.
- Little, Elbert L., Jr.
1953a. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dep. Agric., Agric. Handb. 41, 472 p.
- Little, Elbert L., Jr.
1953b. A natural hybrid spruce in Alaska. *J. For.* 51: 745-747.
- Little, Elbert L., Jr.
1971. Atlas of United States trees, volume 1, conifers and important hardwoods. U.S. Dep. Agric. Misc. Pub. 1146, 9 p. (313 maps, folio).
- Löve, Doris, and Freedman, N. J.
1956. A plant collection from southwest Yukon. *Bot. Not.* 109: 153-211.
- Lutz, H. J.
1956. Ecological effects of forest fires in the interior of Alaska. U.S. Dep. Agric. Tech. Bull. 1133, 121 p.
- Lutz, H. J.
1958. Observations on "diamond willow" with particular reference to its occurrence in Alaska. *Am. Midl. Nat.* 60: 176-185.
- Muller, Siemon William.
1947. Permafrost or permanently frozen ground and related engineering problems. 231 p. Ann Arbor, Mich.: J. W. Edwards, Inc.
- Murray, B. M., and Murray, D. F.
1973. Checklist to the flora of Alaskan U.S. IBP tundra biome study sites. U.S. Tundra Biome Data Rep. 73-30, 104 p.
- Orth, Donald J.
1967. Dictionary of Alaska place names. U.S. Geol. Surv. Prof. Pap. 567, 1084 p.
- Ostenfeld, C. H., and Larsen, C. Syrach.
1930. The species of the genus *Larix* and their geographical distribution. *K. Dan. Vidensk. Selsk. Biol. Medd.* 9(2), 107 p.
- Patric, James H., and Black, P. E.
1968. Potential evapotranspiration and climate in Alaska by Thornthwaite's classification, USDA Forest Serv. Res. Pap. PNW-71, 28 p.
- Polunin, N.
1959. Circumpolar Arctic flora. 514 p. Oxf. Univ. Press.
- Porsild, A. E.
1938. Flora of Little Diomed Island in Bering Strait. *Trans. Roy. Soc. Can. Ser. 3, Sect. 5*, 32: 21-38.
- Porsild, A. E.
1939. Contributions to the flora of Alaska. *Rhodora* 41: 141-183, 199-254, 262-301.
- Porsild, A. E.
1944. Vascular plants collected on Kiska and Great Sitkin Islands in the Aleutians by Lt. H. R. McCarthy and Capt. N. Kellas, August, September, and October 1943. *Can. Field-Nat.* 58: 130-131.
- Porsild, A. E.
1965. Some new or critical vascular plants of Alaska and Yukon. *Can. Field-Nat.* 79: 79-90.
- Raup, Hugh M.
1959. The willows of boreal western America. *Contrib. Gray Herb. Harv. Univ.* 185, 95 p.
- Sargent, Charles Sprague.
1926. Manual of the trees of North America (exclusive of Mexico). Ed. 2, reprinted with corrections. 910 p. Boston and New York: Houghton Mifflin Co. (Reprinted 1933; 1961, New York: Dover.)
- Scaman, Edith.
1940. A list of plants from interior Alaska. *Rhodora* 42: 309-349.
- Scott, Richard W.
1972. Ecology and phytogeography of alpine vegetation in the southeastern Wrangell Mountains, Alaska. Ph. D. thesis, Univ. Mich.
- Searby, Harold W.
1968. Climate of Alaska. U.S. Dep. Commer. Environ. Sci. Serv. Adm., Environ. Data Serv., Climatography of the United States No. 60-49. *Climates of the States, Alaska*. 24 p., maps. 1959 (revised and reprinted 1968).
- Shacklette, Hansford T., et al.
1969. Vegetation of Amchitka Island, Aleutian Islands, Alaska. U.S. Geol. Surv. Prof. Pap. 648, 66 p.
- Shetler, Stanwyn.
1963. An annotated list of vascular plants from Cape Sabine, Alaska. *Rhodora* 65: 208-224.
- Shetler, Stanwyn G.
1964. A progress report on the botanical work. P. 114-130. In Dean, Frederick C. *Biological investigations of the Baird and Schwatka Mountains, Brooks Range, Alaska, 1963*, 130 p. Univ. Alaska.
- Society of American Foresters.
1974. Foresters in land-use planning. 280 p. Wash., D.C.
- Spetzman, Lloyd A.
1959. Vegetation of the Arctic slope of Alaska. U.S. Geol. Surv. Prof. Pap. 320-B: 19-58.
- Spetzman, Lloyd A.
1963. Terrain study of Alaska, Part V: vegetation [folded map, 1:2,500,000]. In Engineer Intelligence Study EIS 301. U.S. Dep. Army, Off. Chief Eng. Wash., D.C. (Printed by Army Map Service.)
- Sudworth, George B.
1908. Forest trees of the Pacific slope. USDA Forest Serv. 441 p. Wash., D.C. (Reprinted 1967, New York: Dover.)
- Sudworth, George B.
1913. Forest atlas. Geographic distribution of North American trees. Part I. Pines. U.S. Dep. Agric. Forest Serv. 36 maps (folio).
- Tatewaki, M.
1930-31. Notes on plants of the western Aleutian Islands collected in 1929. Parts 1-2. *Trans. Sapporo Nat. Hist. Soc.* 11: 152-156; 12: 200-209.
- Tatewaki, M., and Kobayashi, Y.
1934. A contribution to the flora of the Aleutian Islands. *J. Fac. Agric. Hokkaido Imp. Univ.* 36, 119 p.
- Taylor, Raymond F.
1929. Pocket guide to Alaska trees. U.S. Dep. Agric. Misc. Publ. 55, 39 p.
- Taylor, Raymond F., and Little, Elbert L., Jr.
1950. Pocket guide to Alaska trees. U.S. Dep. Agric., Agric. Handb. 5, 63 p.

- Thomas, John H.
 1951. A collection of plants from Point Lay, Alaska. *Contrib. Dudley Herb. Stanford Univ.* 4: 53-56.
- Thomas, John H.
 1957. The vascular flora of Middleton Island, Alaska. *Contrib. Dudley Herb. Stanford Univ.* 5: 39-56.
- Trigg, William M.
 1971. Fire season climatic zones of mainland Alaska. USDA Forest Serv. Res. Pap. PNW-126, 12 p.
- U. S. Geological Survey.
 1947. Alaska map A. 1:5,000,000. (Reprinted 1971.)
 U. S. Geological Survey.
 1970. The national atlas of the United States of America. 417 p. (folio). Washington, D.C.
- U. S. National Weather Service.
 1972(?). Alaska, mean annual precipitation— inches. [map.]
- Viereck, Leslie A., and Foote, Joan M.
 1970. The status of *Populus balsamifera* and *P. trichocarpa* in Alaska. *Can. Field-Nat.* 84: 169-173.
- Viereck, Leslie A., and Little, Elbert L., Jr.
 1972. Alaska trees and shrubs. U.S. Dep. Agric., Agric. Handb. 410, 265 p.
- Wahrhaftig, Clyde.
 1965. Physiographic divisions of Alaska. U.S. Geol. Surv. Prof. Pap. 482, 52 p.
- Watson, C. E.
 1959. Climates of the States, Alaska. U. S. Weather Bureau, Climatography of the United States No. 60-49. 24 p., maps.
- Whitford, H. N., and Craig, R. D.
 1918. Forests of British Columbia. 409 p. Ottawa.
- Wiggins, Ira L., and MacVicar, D. G.
 1958. Notes on the plants in the vicinity of Chandler Lake, Alaska. *Contrib. Dudley Herb. Stanford Univ.* 5: 69-95.
- Wiggins, Ira L., and Thomas J. H.
 1962. A flora of the Alaskan Arctic slope. *Arct. Inst. North Am. Spec. Publ.* 4, 425 p.
- Worley, Ian A., and Jaques, Dennis.
 1973. Subalpine fir (*Abies lasiocarpa*) in coastal western North America. *Northwest Sci.* 47: 265-273.
- Zoltai, S. C.
 1973. The range of tamarack (*Larix laricina* (Du Roi) K. Koch) in northern Yukon Territory. *Can. J. For. Res.* 3: 461-464.

MAPS

General Maps 1-23

Species Maps 1-82



1. NORTH AMERICA

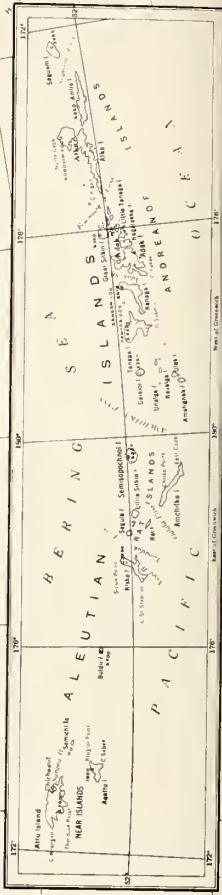
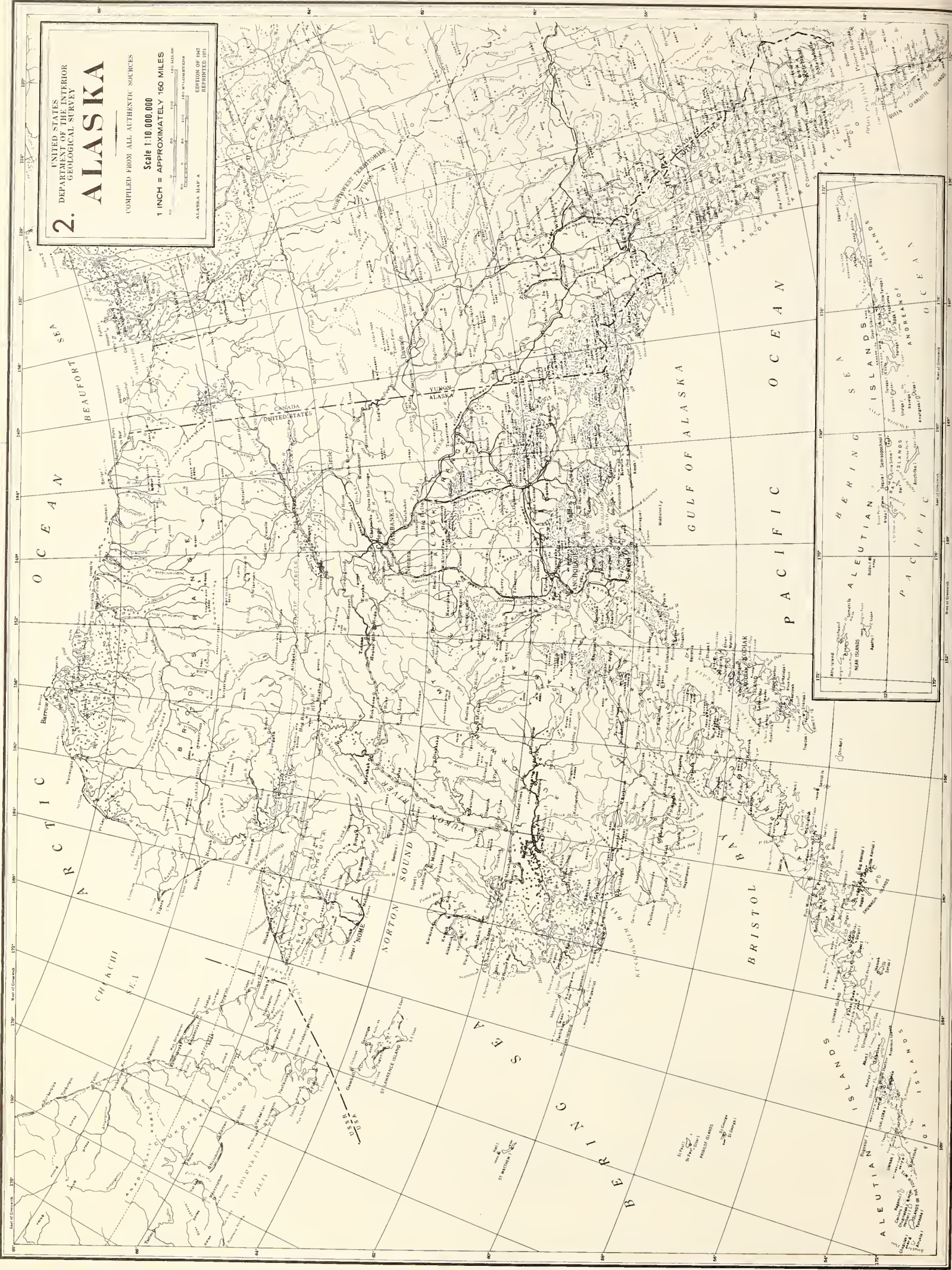
2. ALASKA

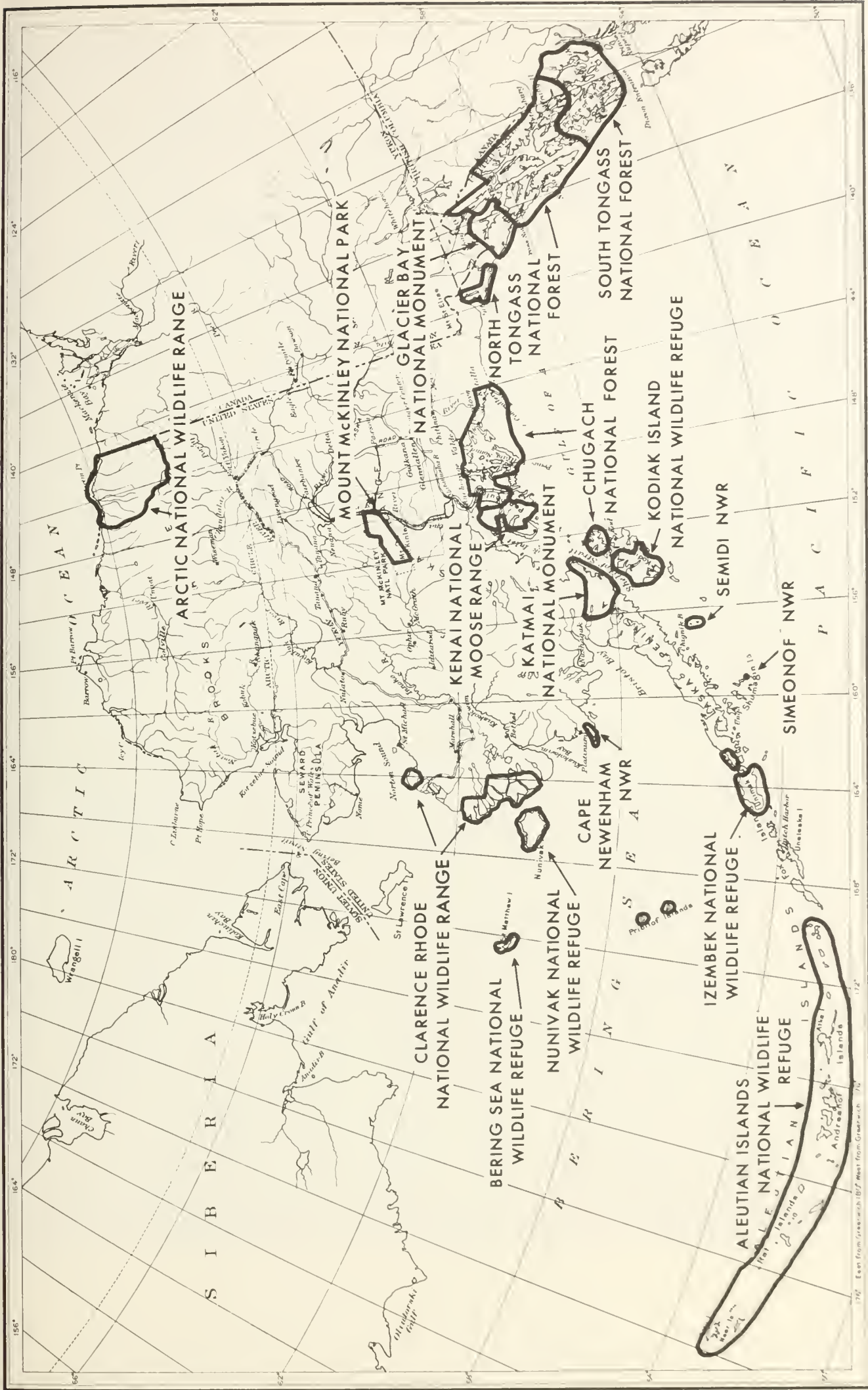
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMPILED FROM ALL AUTHENTIC SOURCES

Scale 1:10,000,000
1 INCH = APPROXIMATELY 160 MILES

EDITION OF 1917
REPRINTED 1911
ALASKA MAP-A









INTERIOR GEOLOGICAL SURVEY WASHINGTON, D. C. 1954

ALASKA

Scale: 0 100 200 Miles
0 100 200 Kilometers

3. NATIONAL FORESTS, PARKS, and WILDLIFE REFUGES

4. TOPOGRAPHY

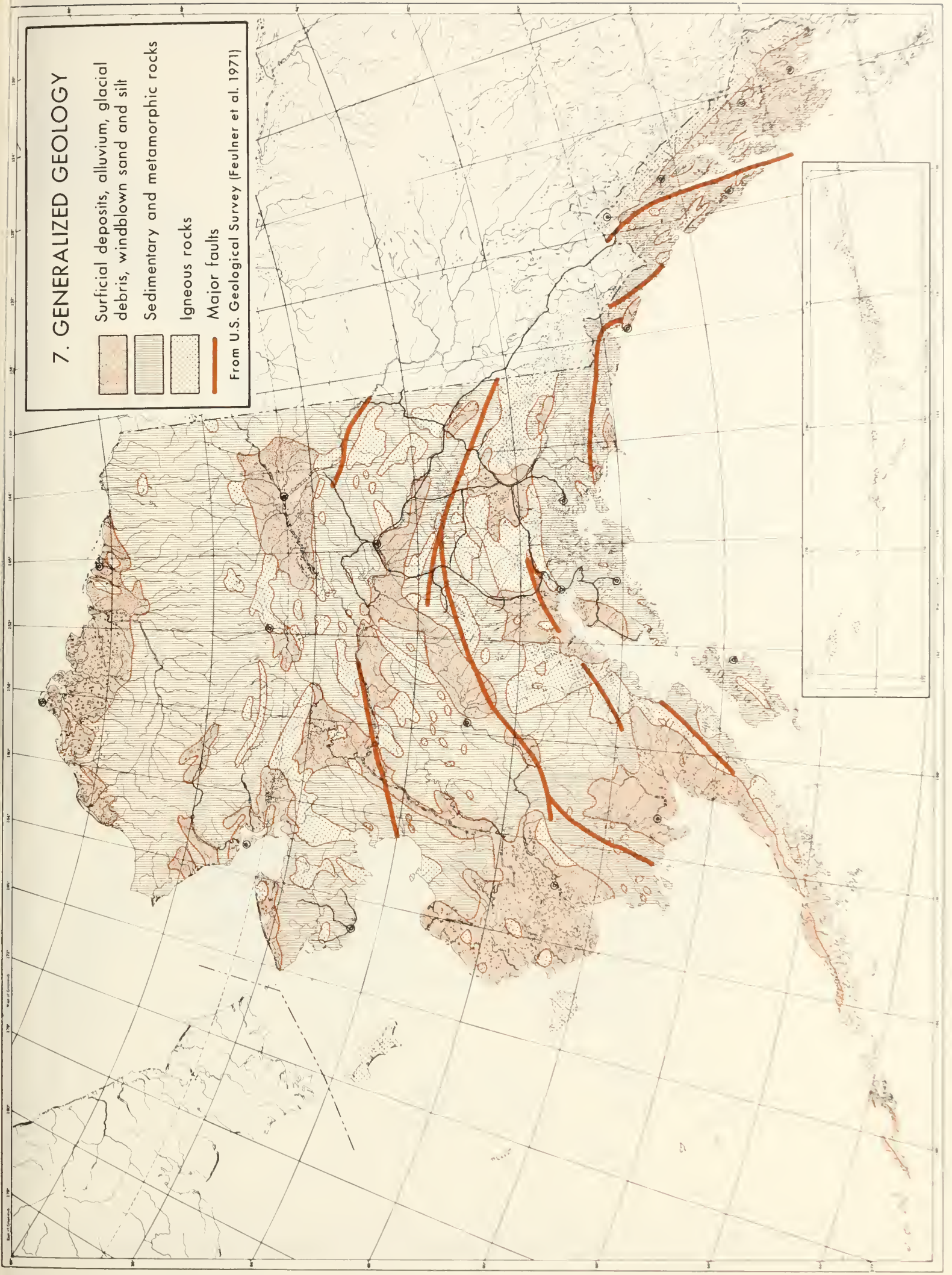
-  Lands generally less than 1,000 feet
 -  Lands between 1,000 and 2,000 feet
 -  Lands between 2,000 and 5,000 feet
 -  Lands generally above 5,000 feet
- Adapted from Major Ecosystems of Alaska (1973)



7. GENERALIZED GEOLOGY

- Surficial deposits, alluvium, glacial debris, windblown sand and silt
- Sedimentary and metamorphic rocks
- Igneous rocks
- Major faults




From U.S. Geological Survey (Feulner et al. 1971)

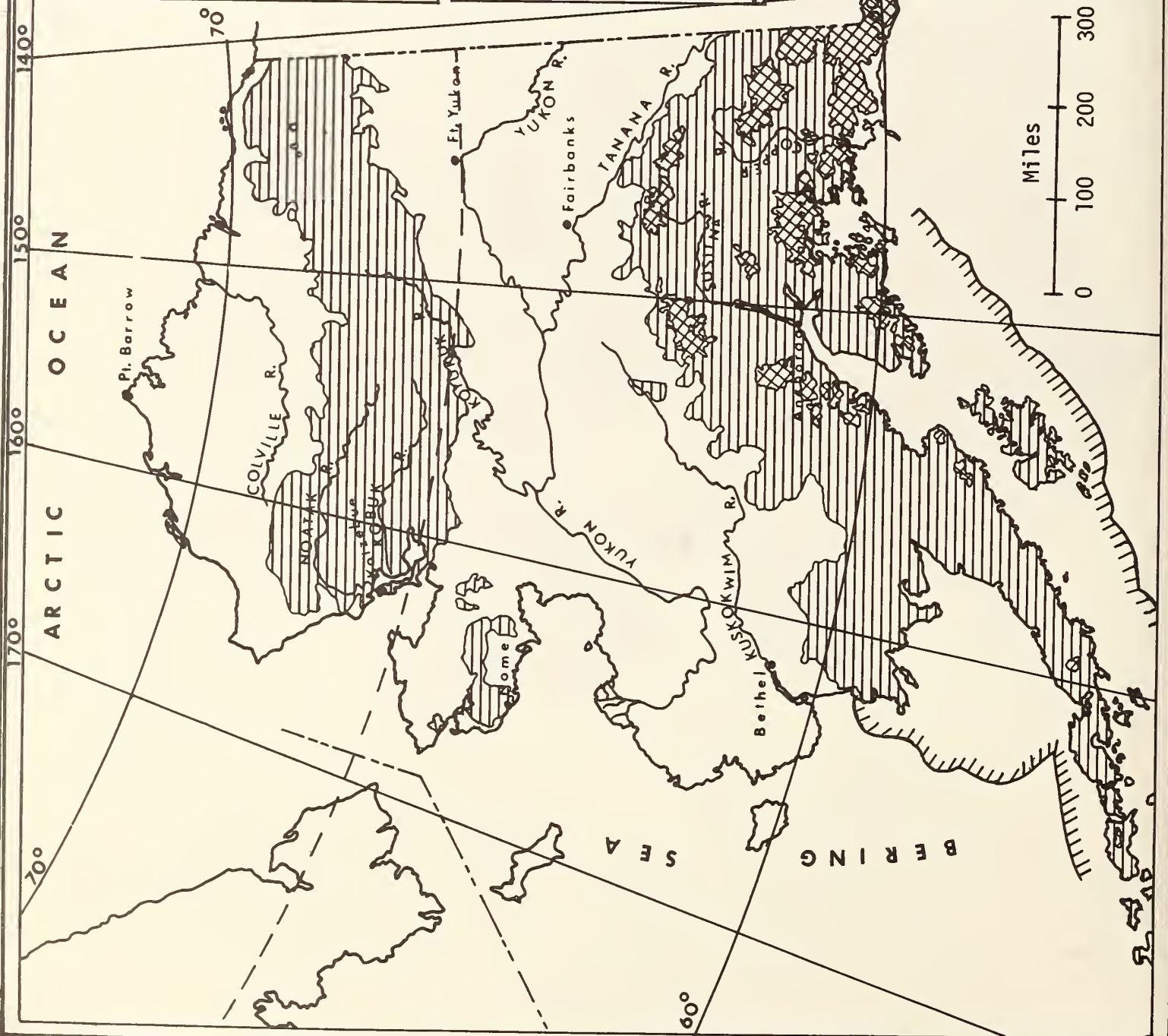


8. EXTENT OF GLACIATION IN ALASKA

From U.S. Geological Survey
(Coulter et al. 1965)
and
Environmental Atlas of Alaska

LEGEND

-  Areas covered by ice during Pleistocene time.
-  Areas covered by existing glaciers.
-  Outer limit of significant glacial advance.



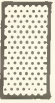



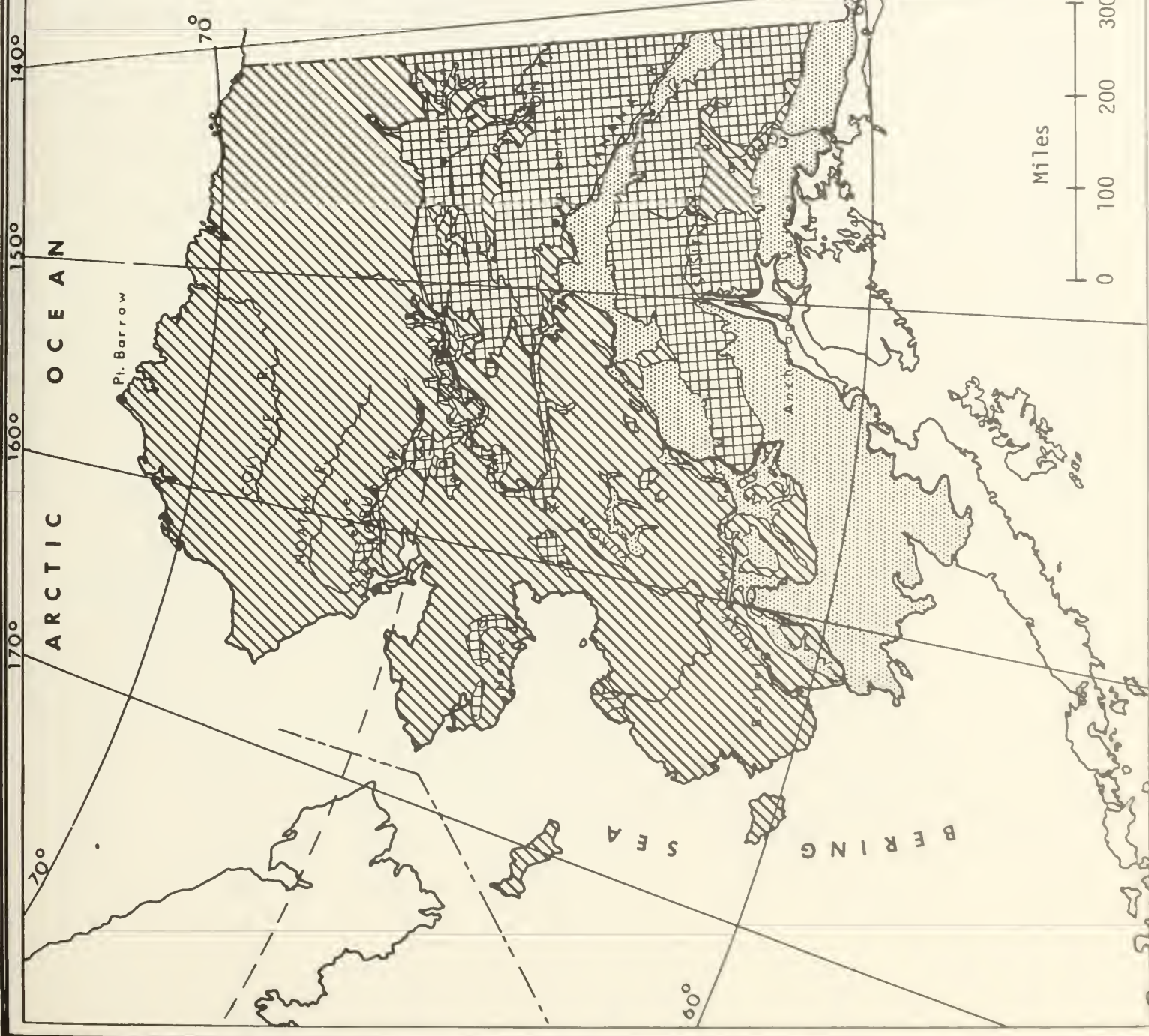
9. PERMAFROST

From U.S. Geological Survey
(Ferrians 1965)

and
Environmental Atlas of Alaska

LEGEND

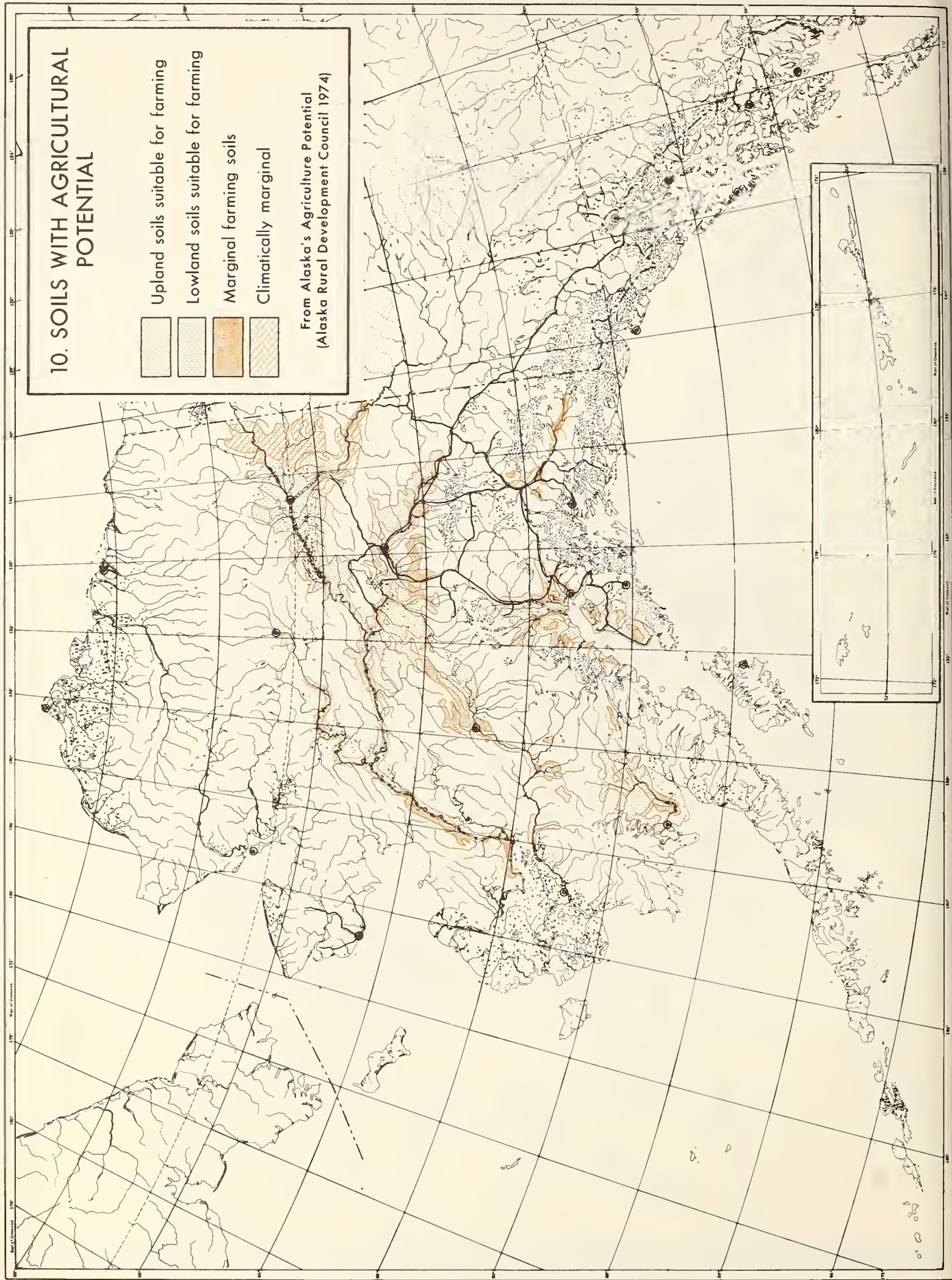
-  Generally underlain by continuous permafrost.
-  Underlain by discontinuous permafrost.
-  Underlain by isolated masses of permafrost.
-  Generally free from permafrost.



10. SOILS WITH AGRICULTURAL POTENTIAL

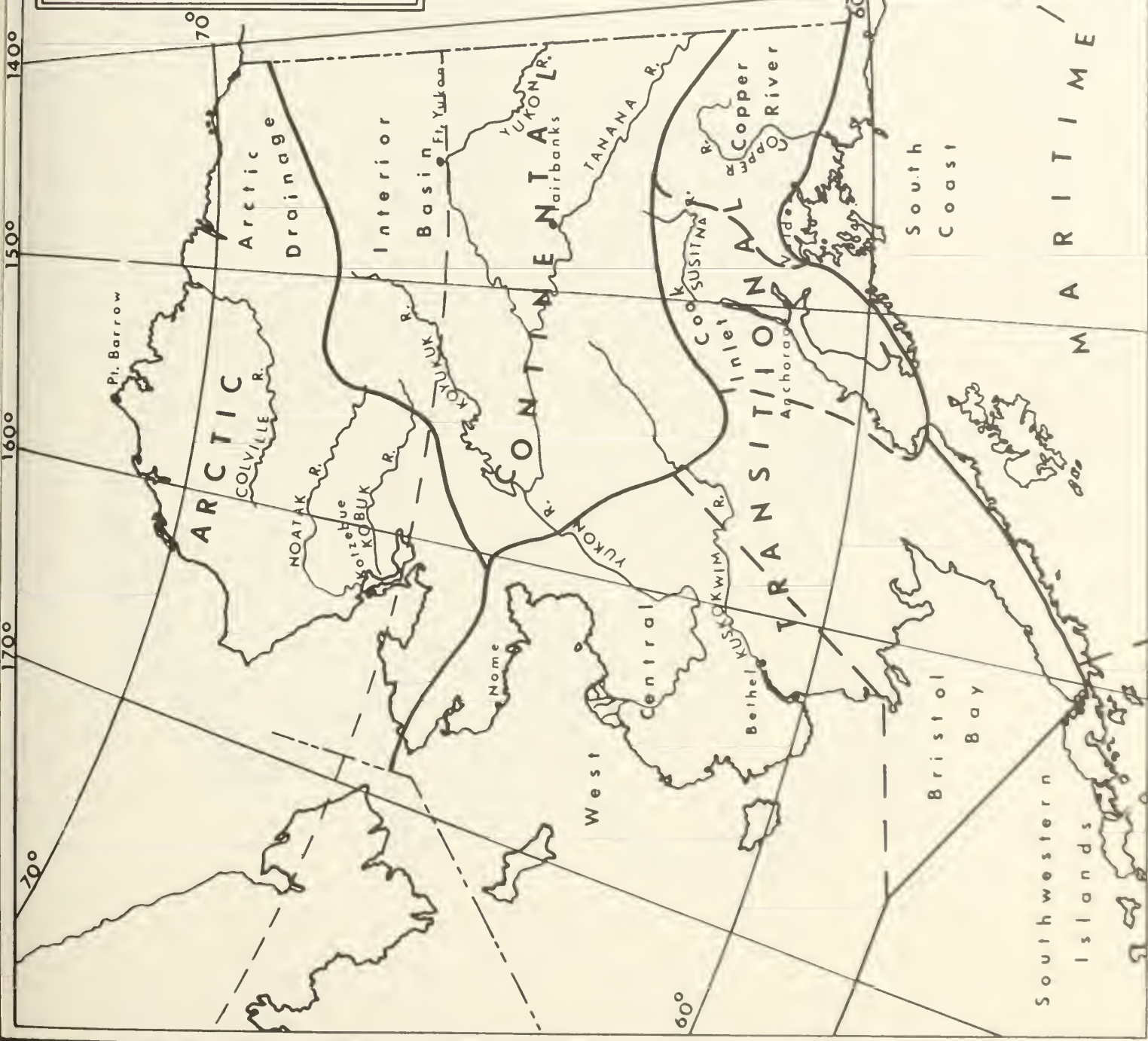
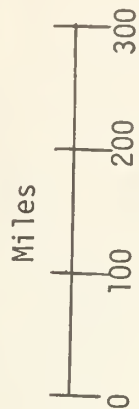
- Upland soils suitable for farming
- Lowland soils suitable for farming
- Marginal farming soils
- Climatically marginal

From Alaska's Agriculture Potential
(Alaska Rural Development Council 1974)



11. CLIMATIC ZONES

From National Weather Service
(Watson 1959),
Environmental Sciences Services
Administration,
and Environmental Atlas of Alaska



12. HYDROLOGY

Major watersheds or drainage basins and their subdivisions

From Major Ecosystems of Alaska (1973)

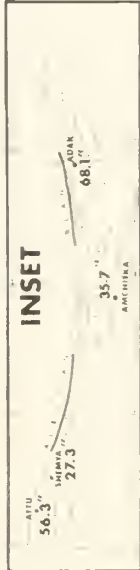
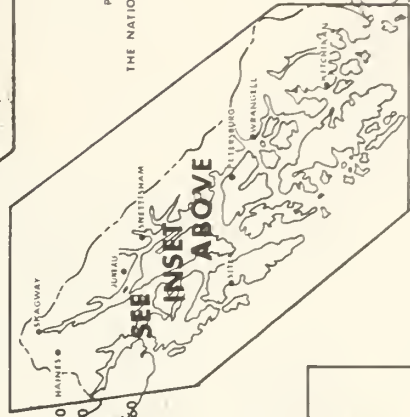
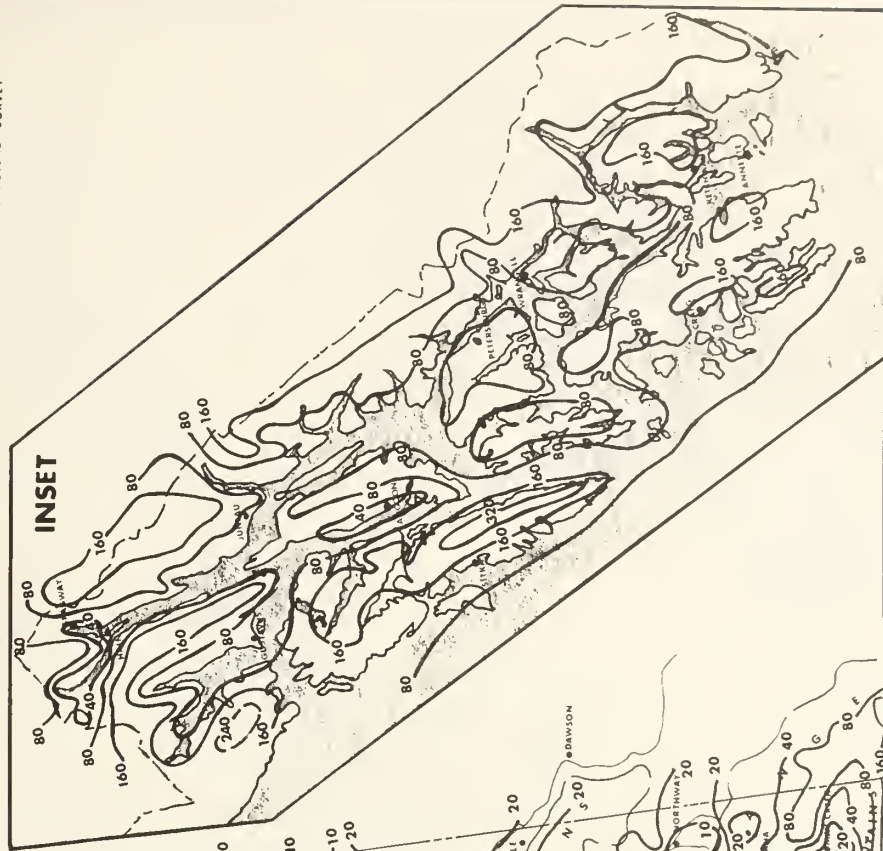


13. MEAN ANNUAL PRECIPITATION - INCHES

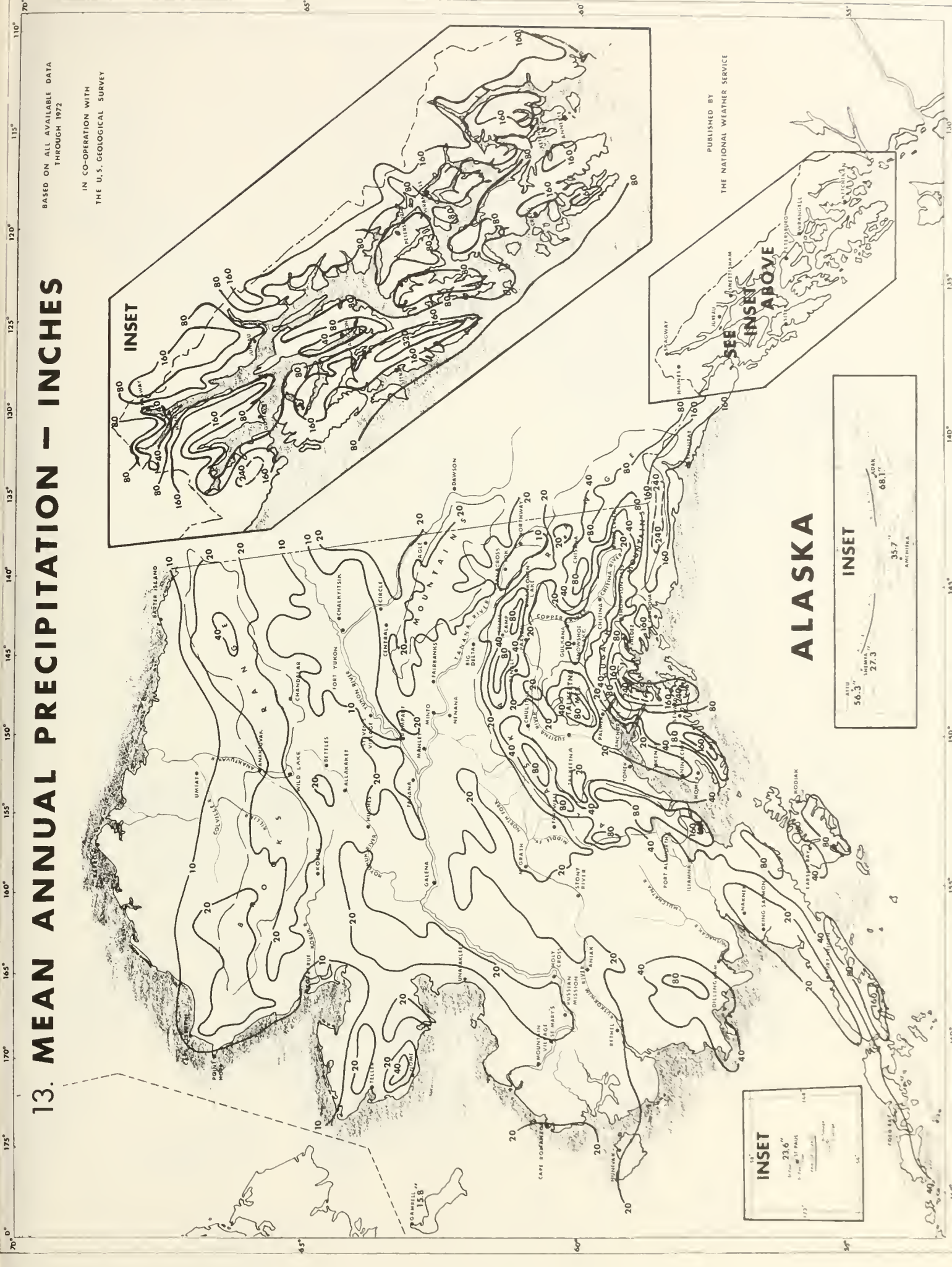
BASED ON ALL AVAILABLE DATA THROUGH 1972

IN CO-OPERATION WITH THE U.S. GEOLOGICAL SURVEY

PUBLISHED BY THE NATIONAL WEATHER SERVICE



ALASKA



175° 170° 165° 160° 155° 150° 145° 140° 135° 130° 125° 120° 115° 110°

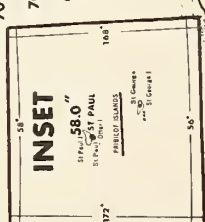
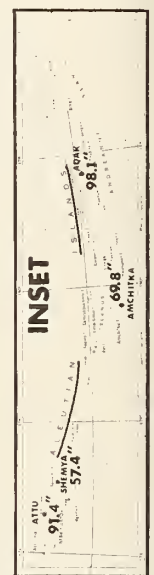
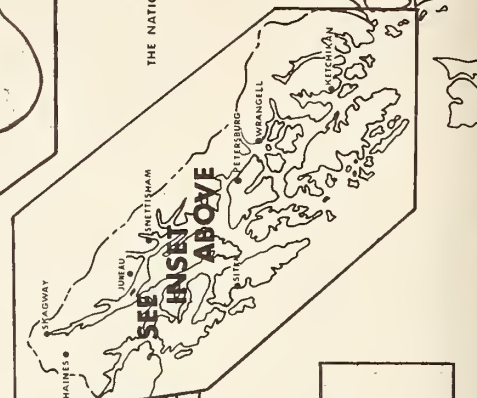
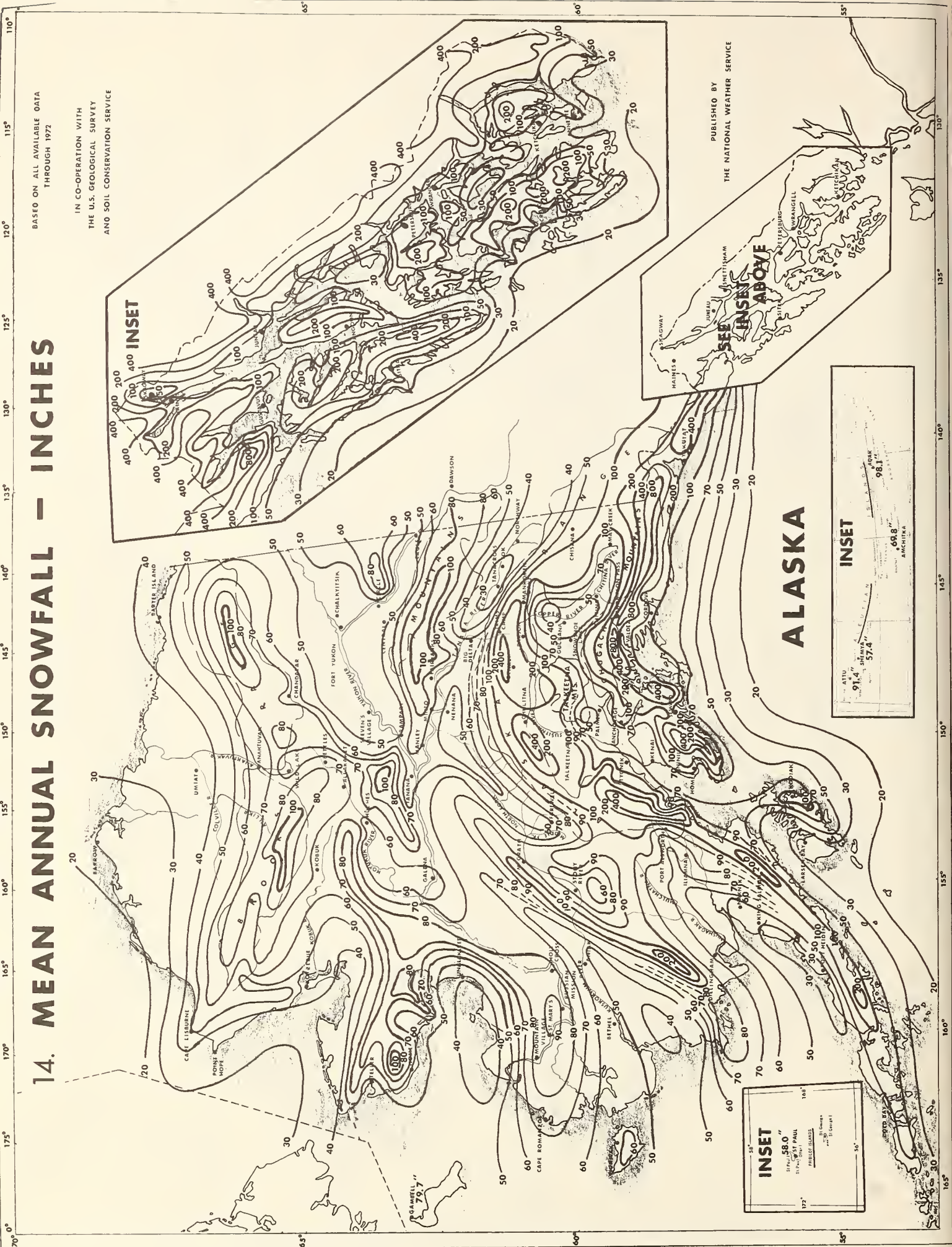
70° 65° 60° 55° 50° 45°

14. MEAN ANNUAL SNOWFALL - INCHES

BASED ON ALL AVAILABLE DATA THROUGH 1972

IN CO-OPERATION WITH THE U.S. GEOLOGICAL SURVEY AND SOIL CONSERVATION SERVICE

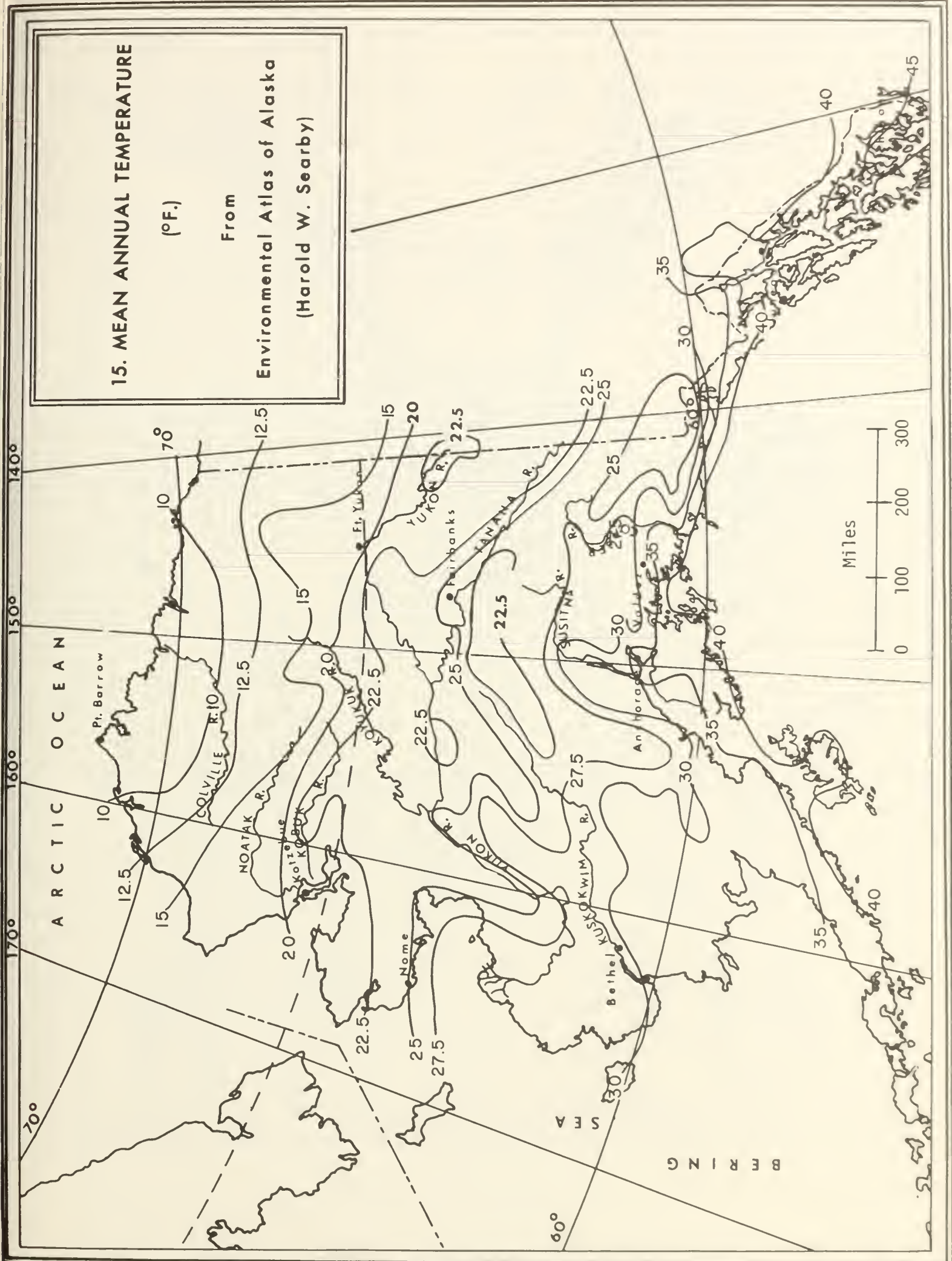
PUBLISHED BY THE NATIONAL WEATHER SERVICE



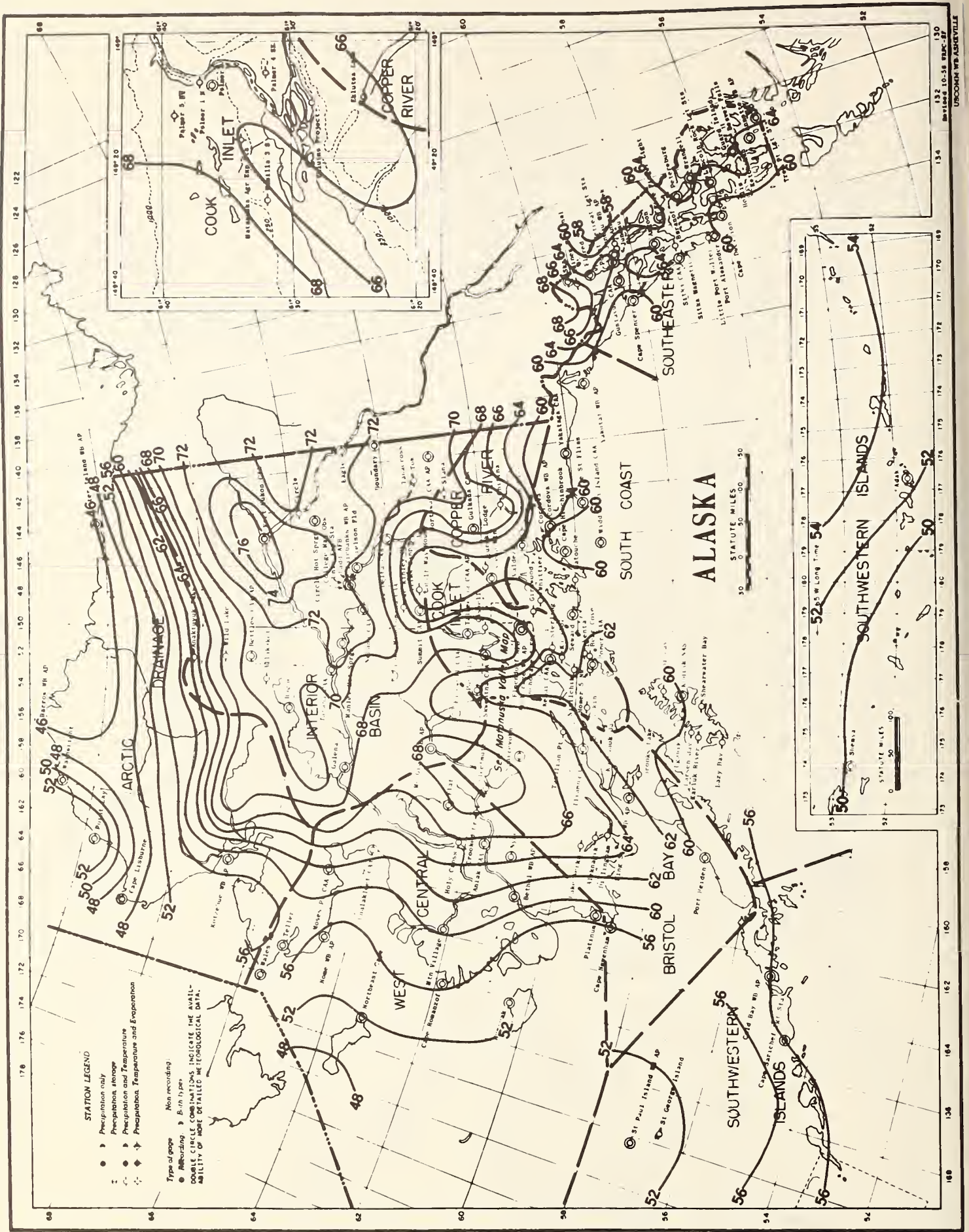
15. MEAN ANNUAL TEMPERATURE

(°F.)

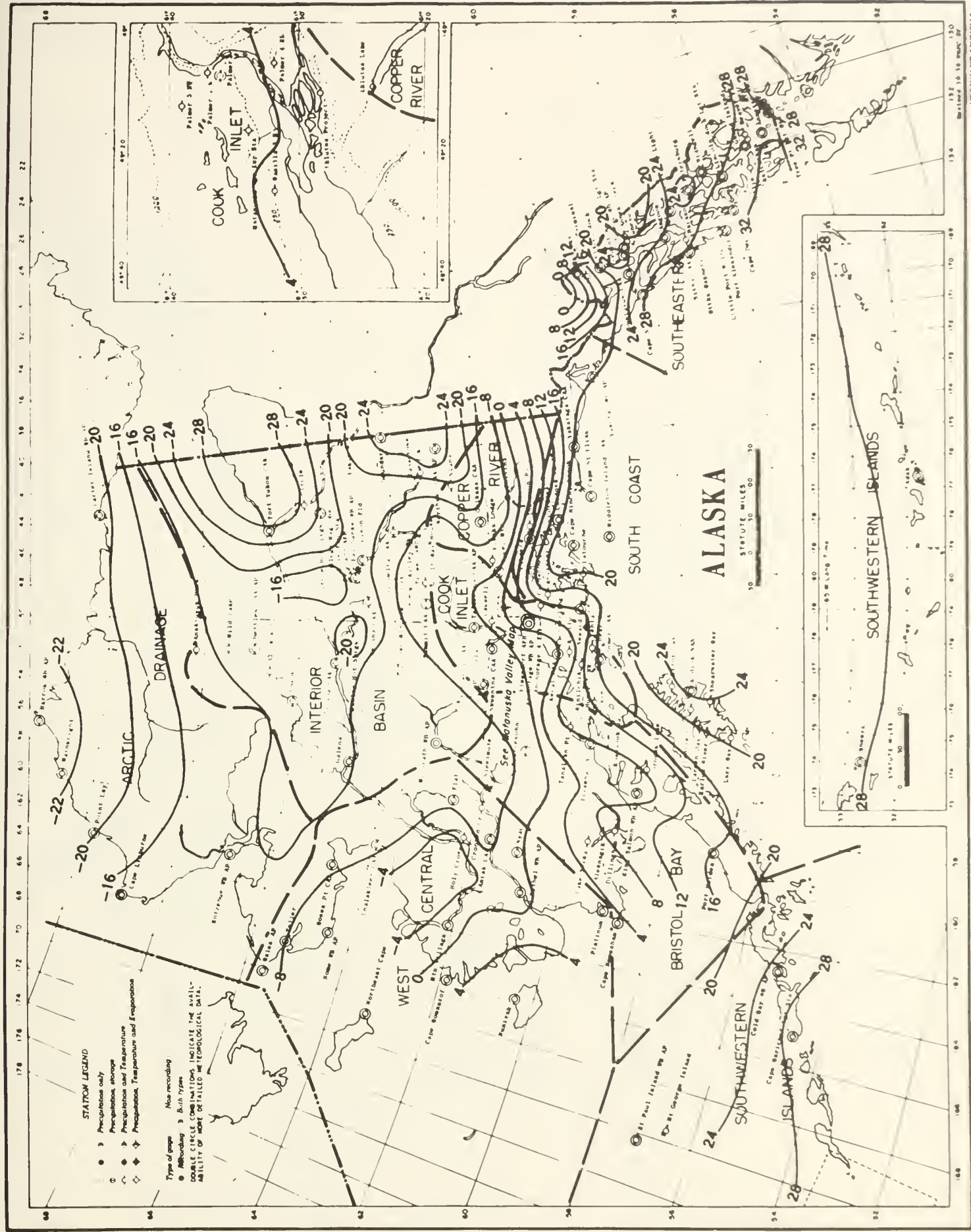
From
Environmental Atlas of Alaska
(Harold W. Searby)



16. Mean Maximum Temperature (°F.), July



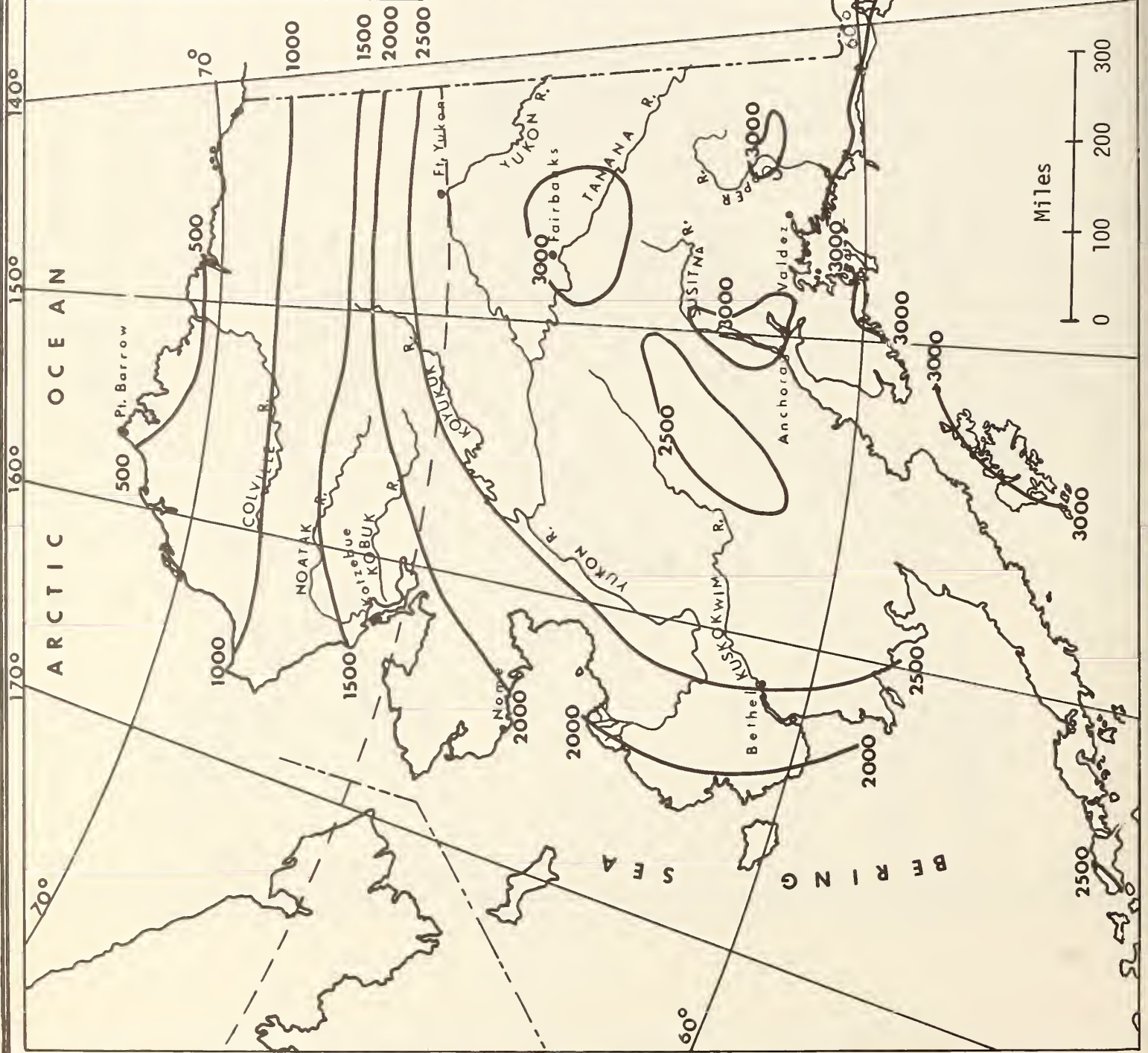
17. Mean Minimum Temperature (°F.), January



18. THAWING INDEX

From
Environmental Atlas of Alaska
and
U.S. Weather Bureau (1965)

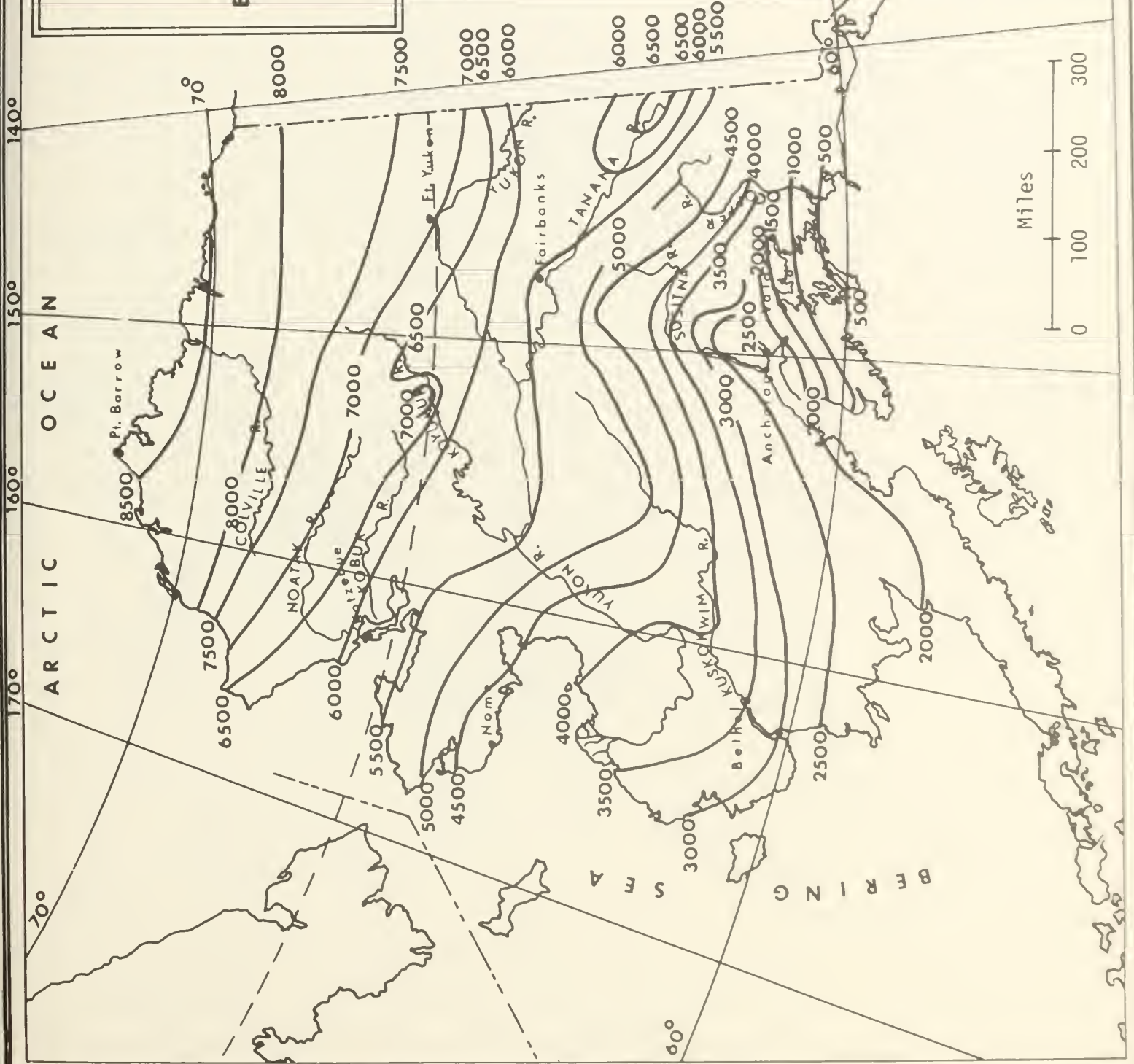
Thawing index is the number of
degree days above freezing for
one year.



19. FREEZING INDEX

From
Environmental Atlas of Alaska
and
U.S. Weather Bureau (1965)

Freezing index is the number of
degree days below freezing for
one year.



20. PLANT HARDINESS ZONES

Based on average annual minimum temperature (°F.)

Areas where plant growth is severely restricted due to extreme climatic factors

- Zones 1 and 2 -70° to -40°
- Zone 3 -40° to -30°
- Zone 4 -30° to -20°
- Zone 5 -20° to -10°
- Zone 6 -10° to 0°

From Alan C. Eps, University of Alaska (1973)



21. FIRE SEASON CLIMATIC ZONES

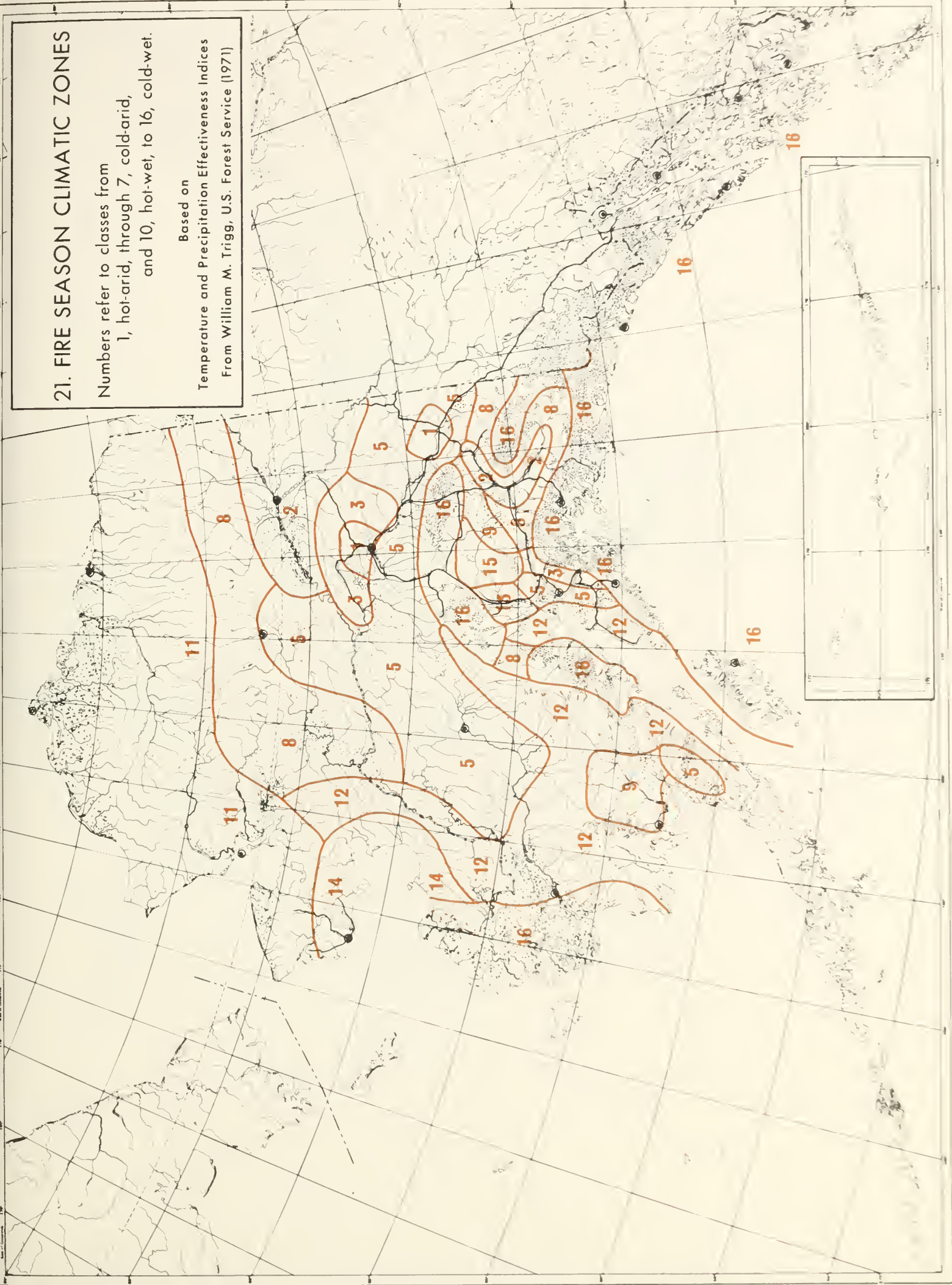
Numbers refer to classes from

1, hot-arid, through 7, cold-arid,
and 10, hot-wet, to 16, cold-wet.

Based on

Temperature and Precipitation Effectiveness Indices

From William M. Trigg, U.S. Forest Service (1971)



22. VEGETATION OF ALASKA

COASTAL FORESTS

1. Sitka spruce—hemlock

INTERIOR FORESTS or TAIGA

2. Closed spruce—hardwood forests

3. Open, low growing spruce forests and treeless bogs

TUNDRA or TREELESS

4. Moist tundra

5. Wet tundra

6. Alpine tundra, ice and snow



23. FORESTS OF ALASKA

COASTAL



1. Sitka spruce-hemlock forests

INTERIOR



2. Spruce-hardwood forests

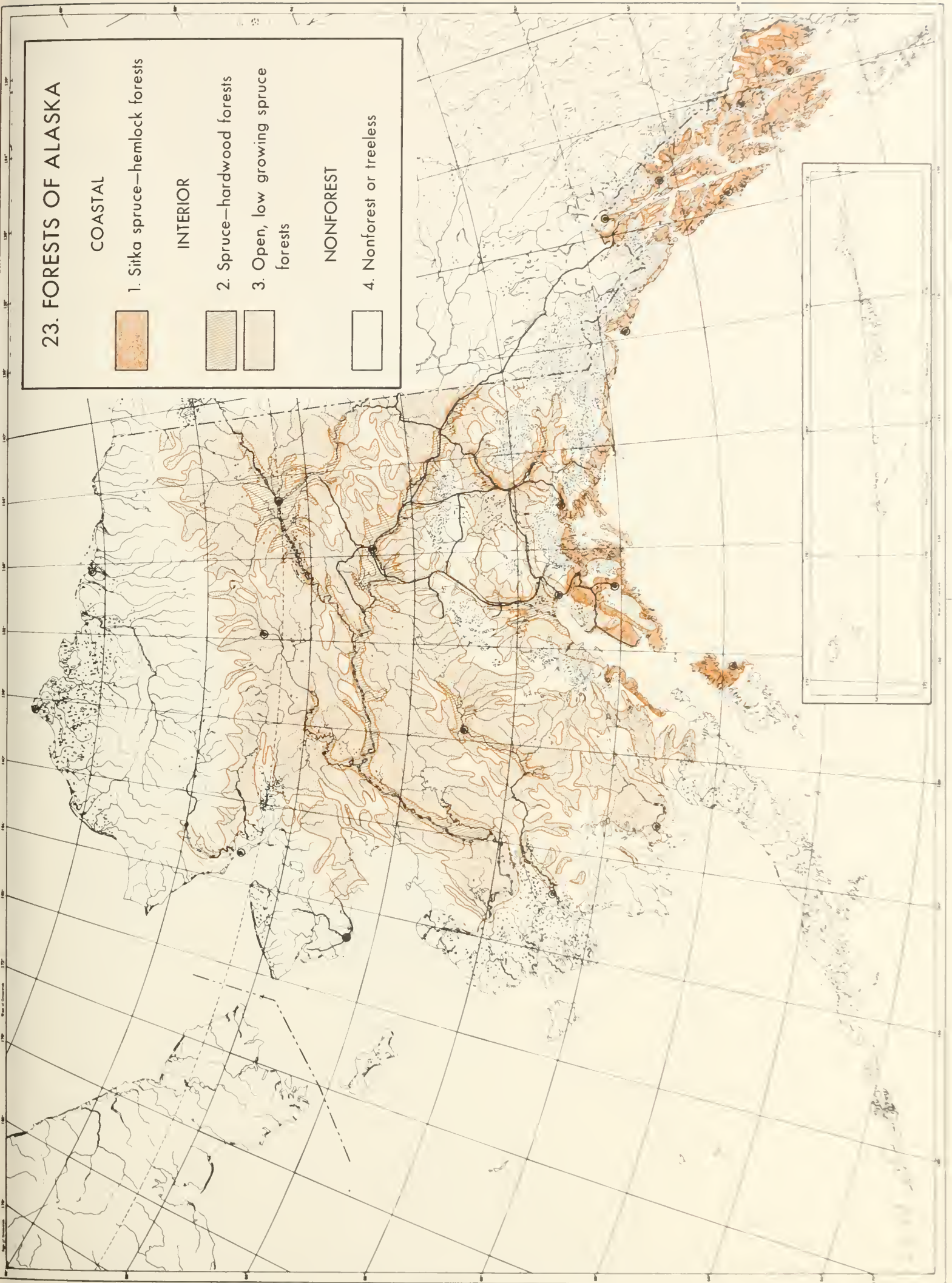


3. Open, low growing spruce forests

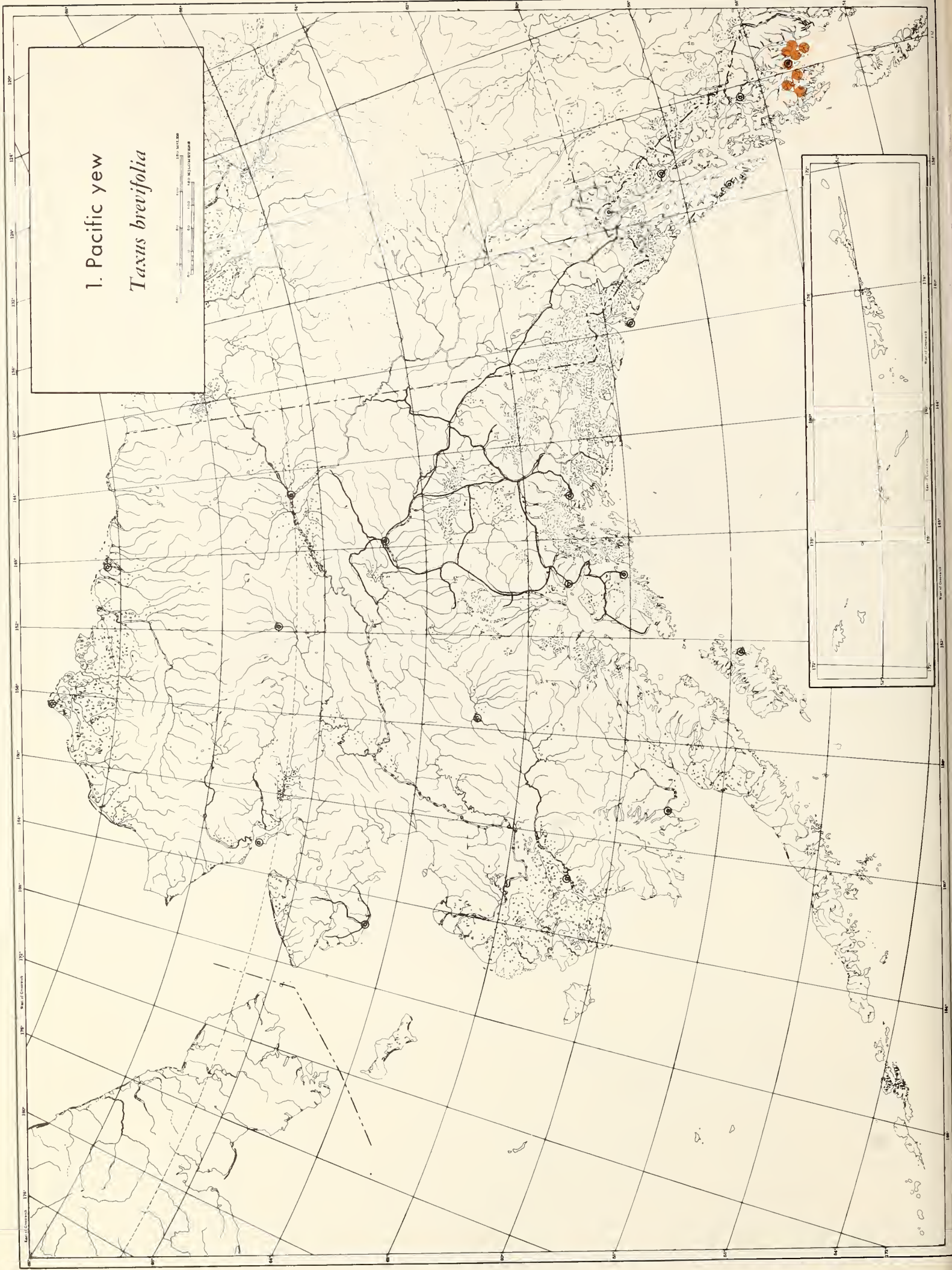
NONFOREST



4. Nonforest or treeless



1. Pacific yew
Taxus brevifolia



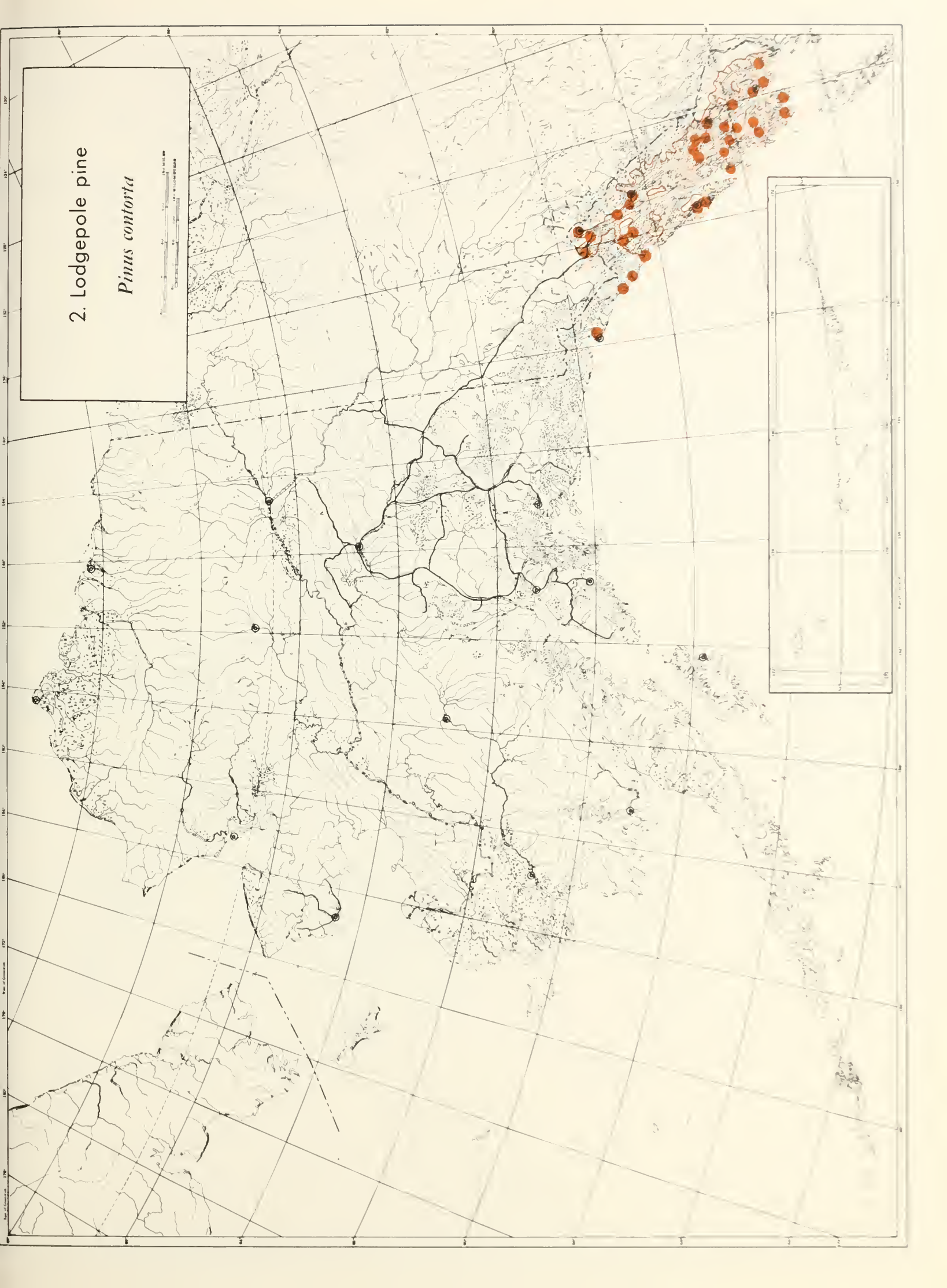
Map of California

Map of Oregon

Map of Washington

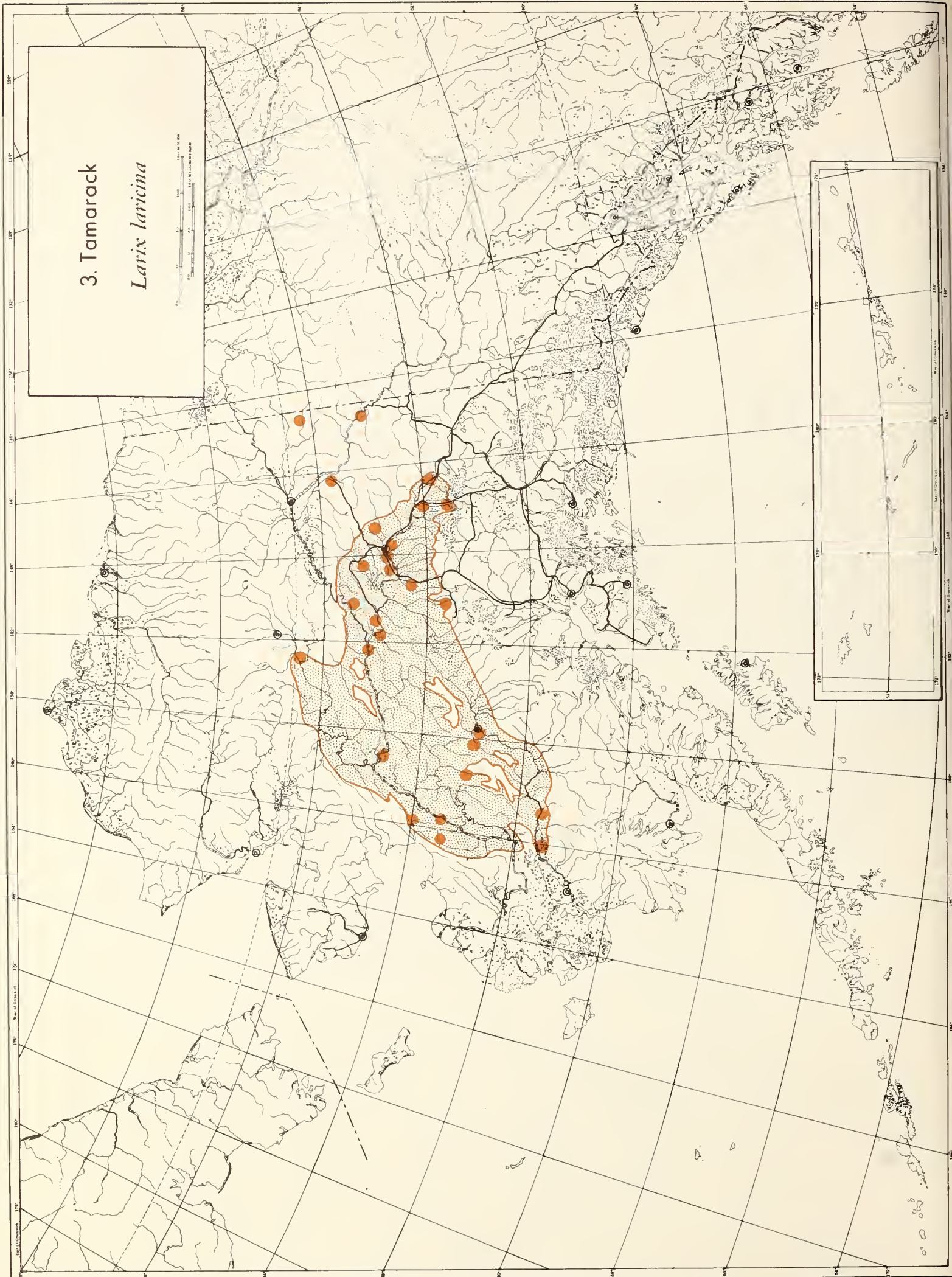
2. Lodgepole pine

Pinus contorta

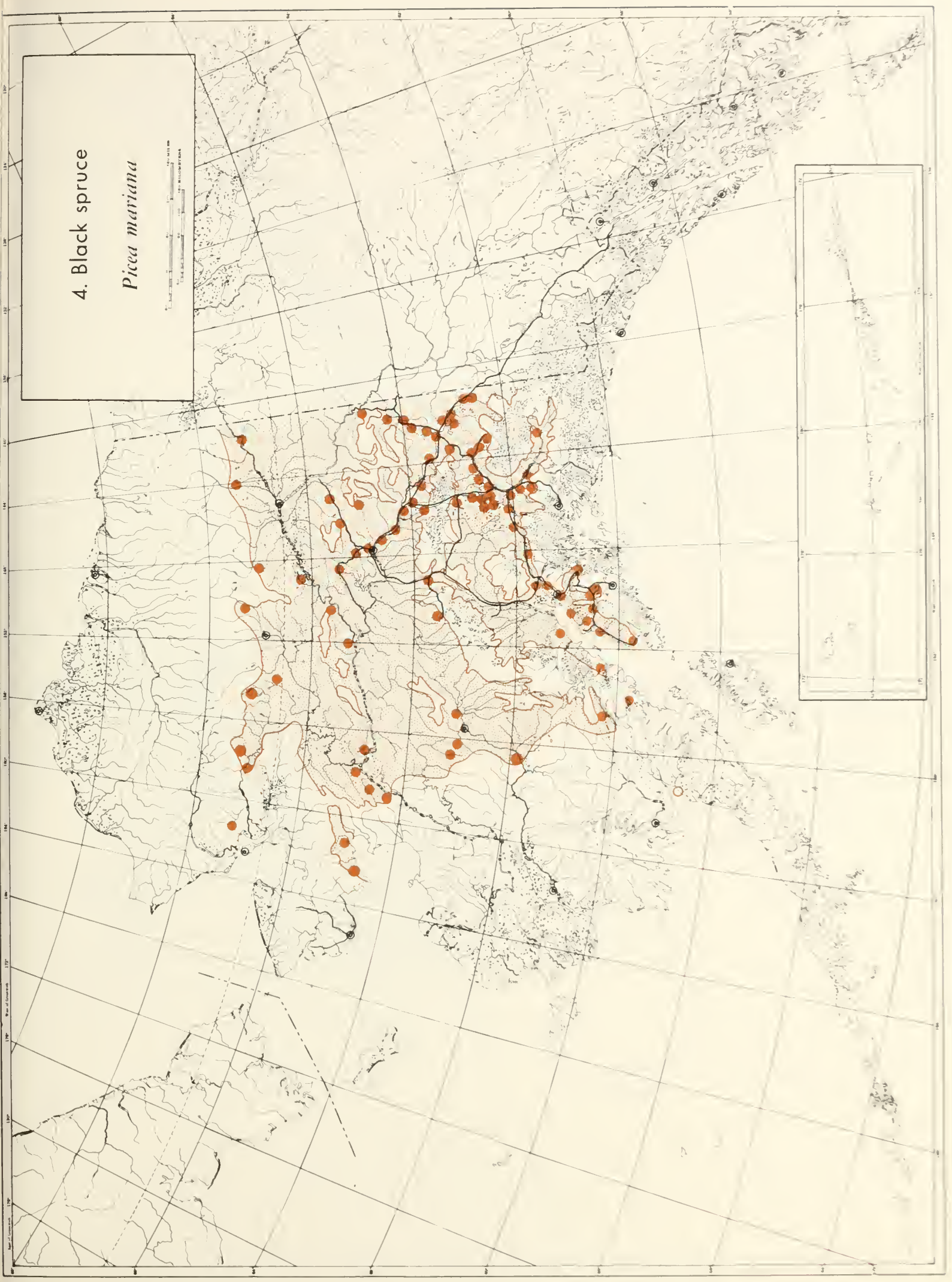


3. Tamarack

Larix laricina



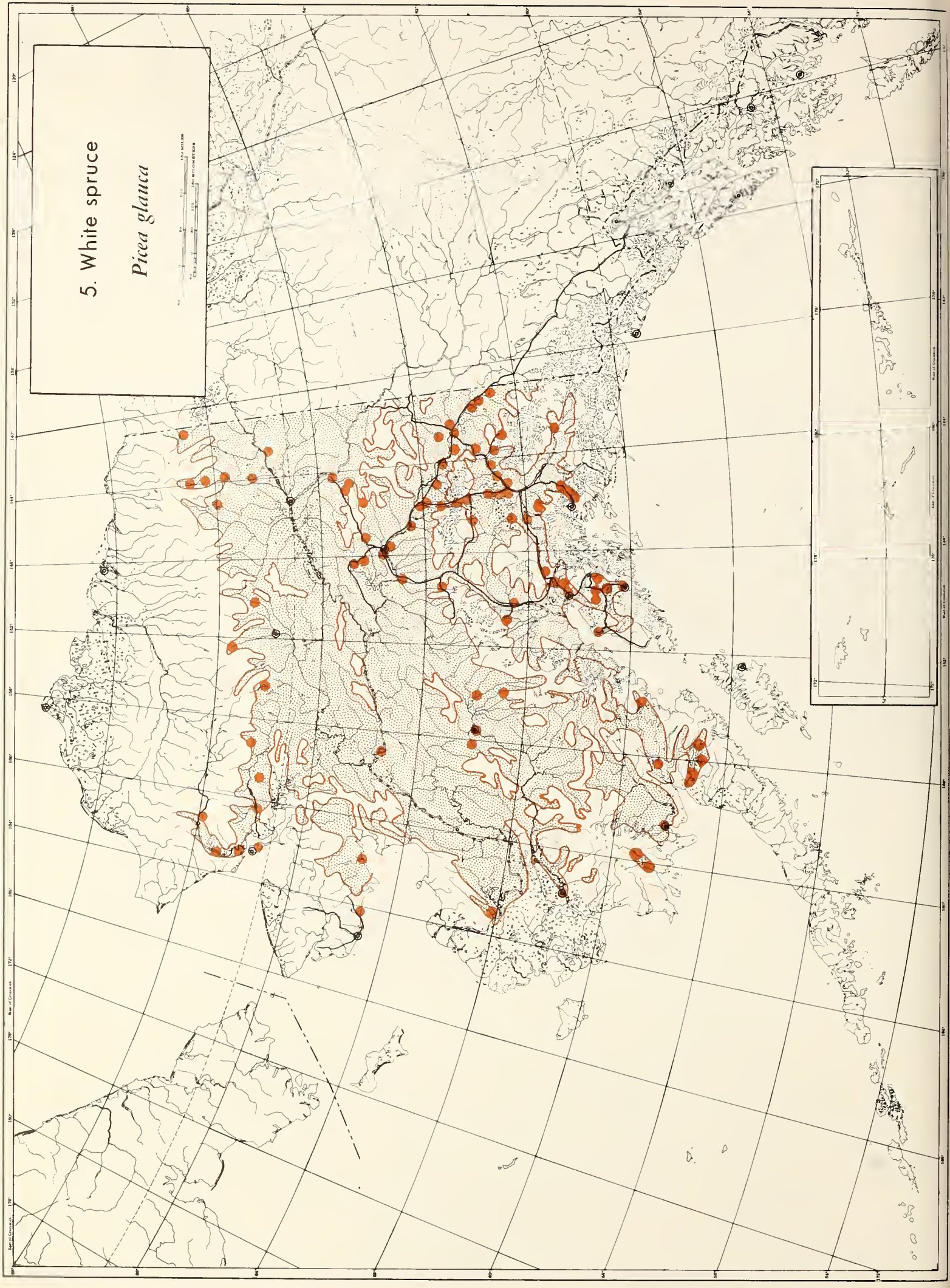
4. Black spruce
Picea mariana



Map of Alaska, 1909
State of Alaska, 1909

5. White spruce

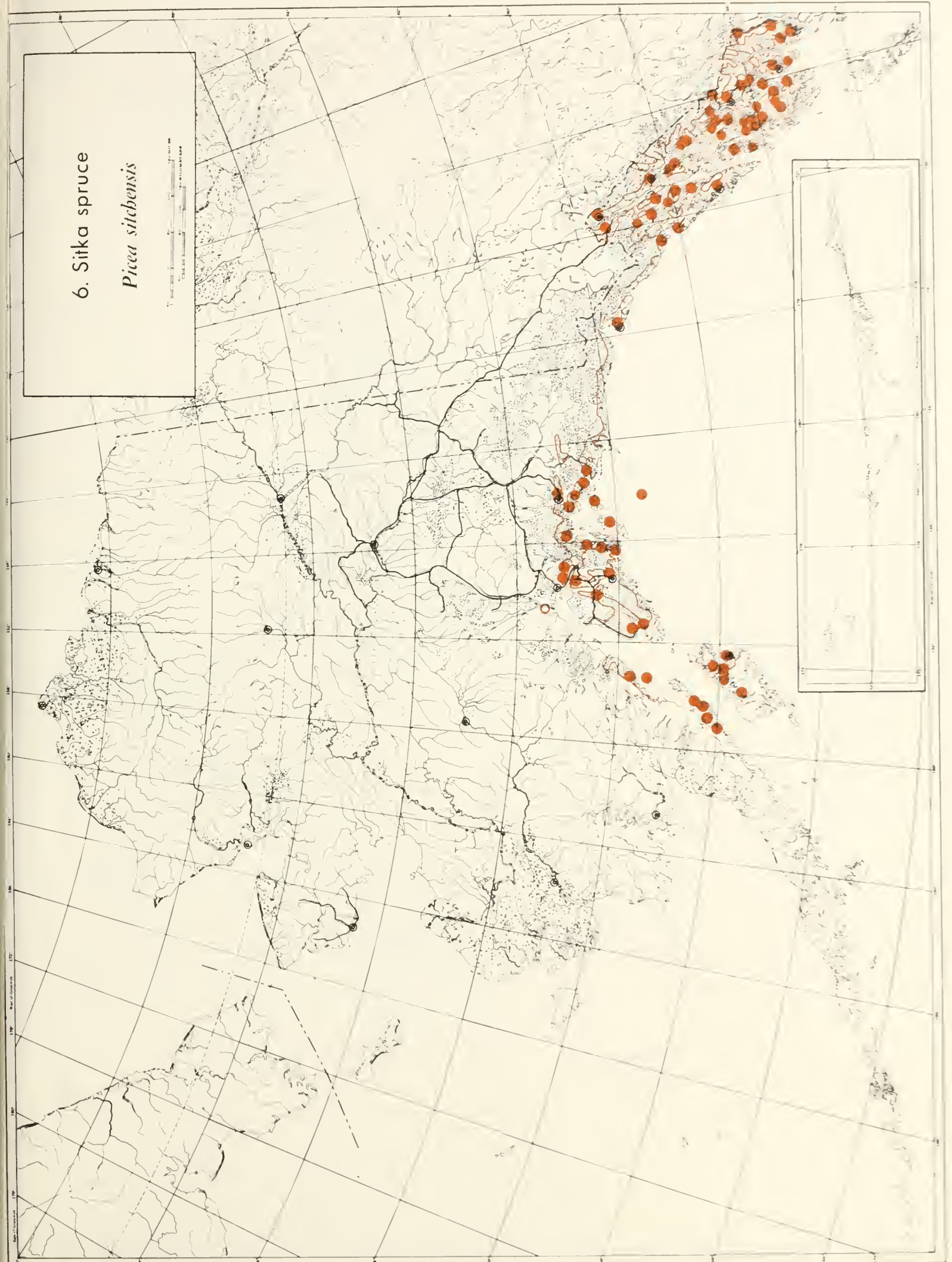
Picea glauca



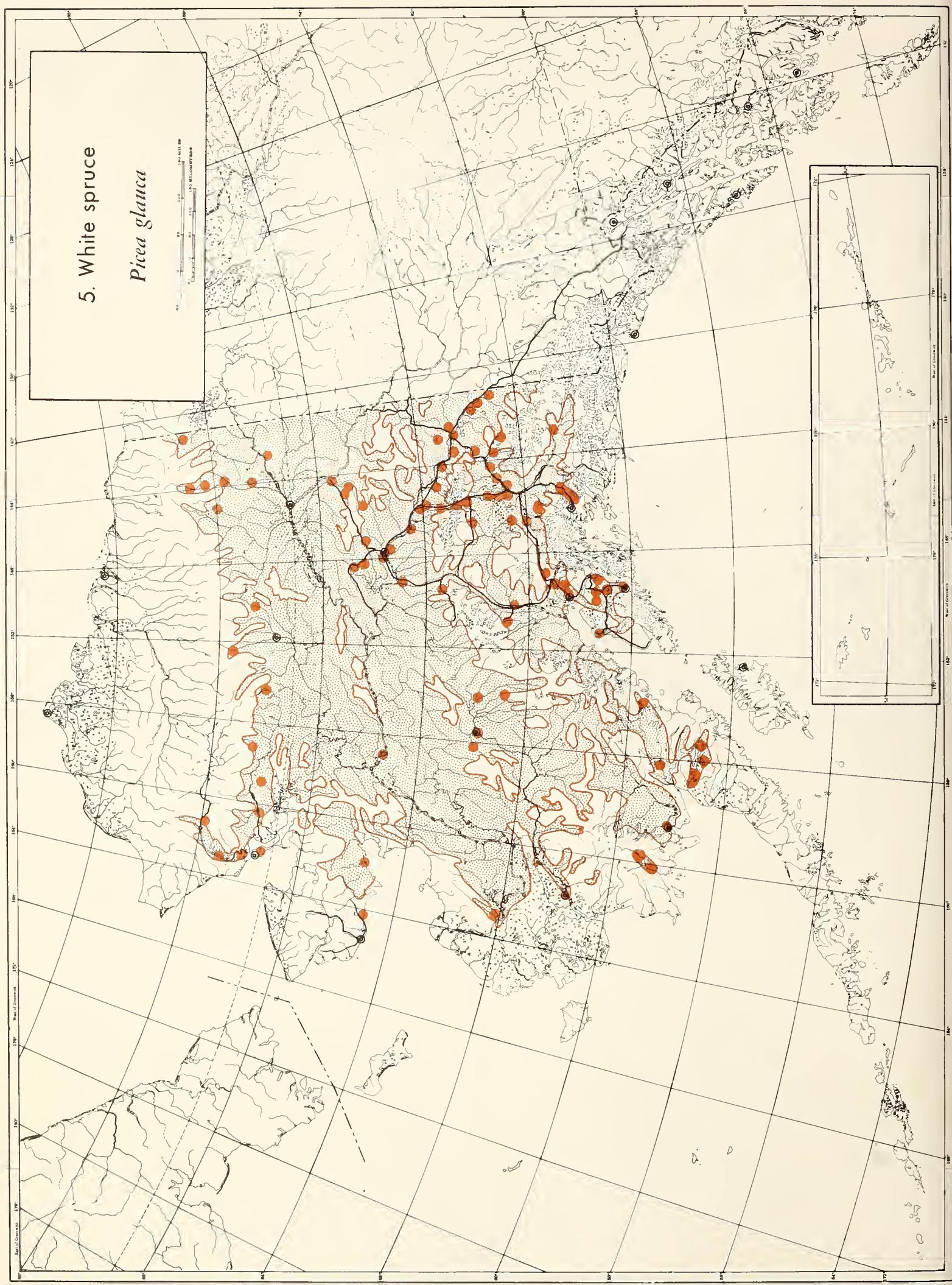
6. Sitka spruce

Picea sitchensis

Scale: 1:100,000
1:200,000
1:400,000
1:800,000
1:1,600,000

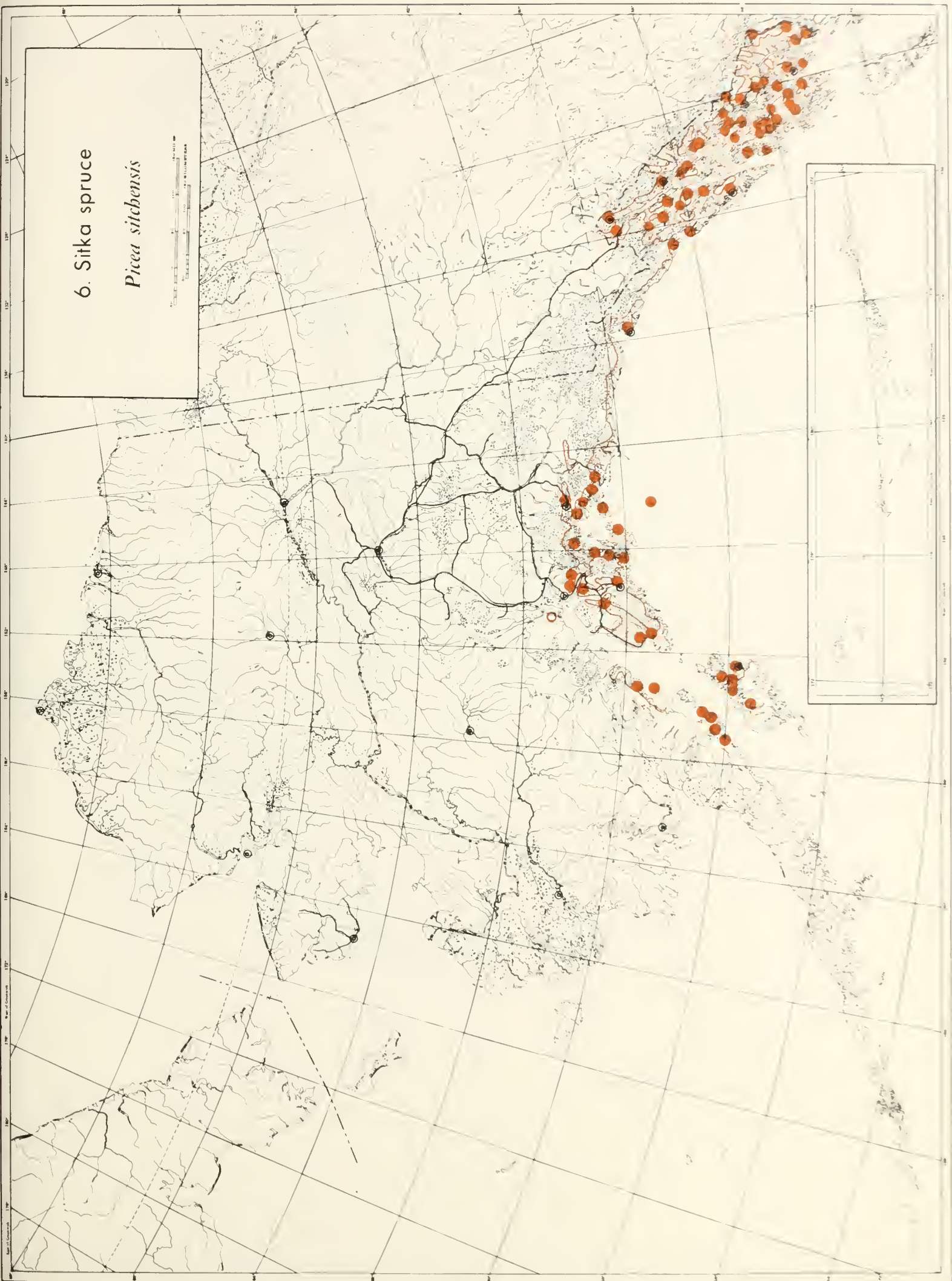
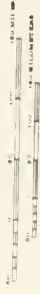


5. White spruce
Picea glauca



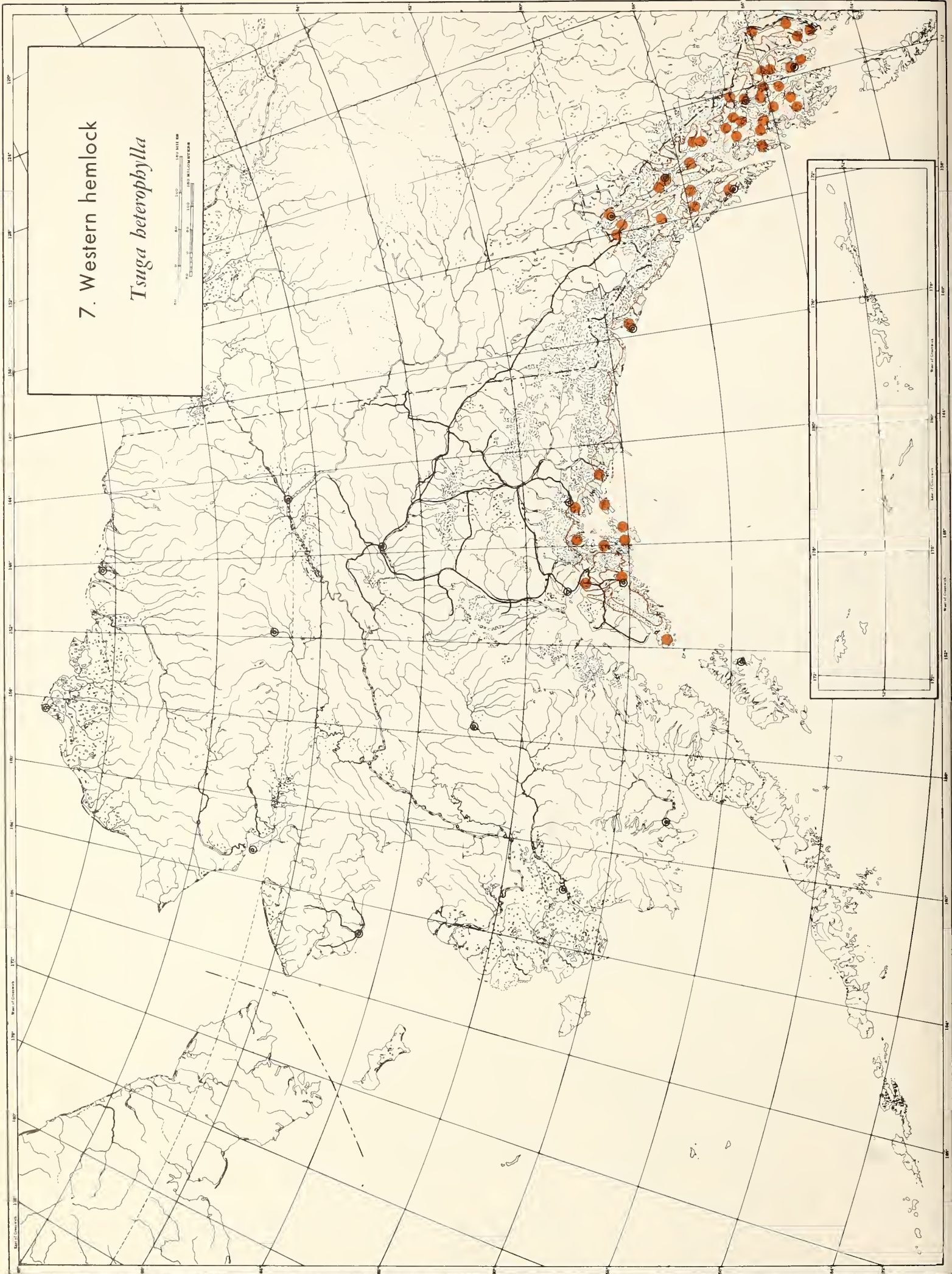
6. Sitka spruce

Picea sitchensis



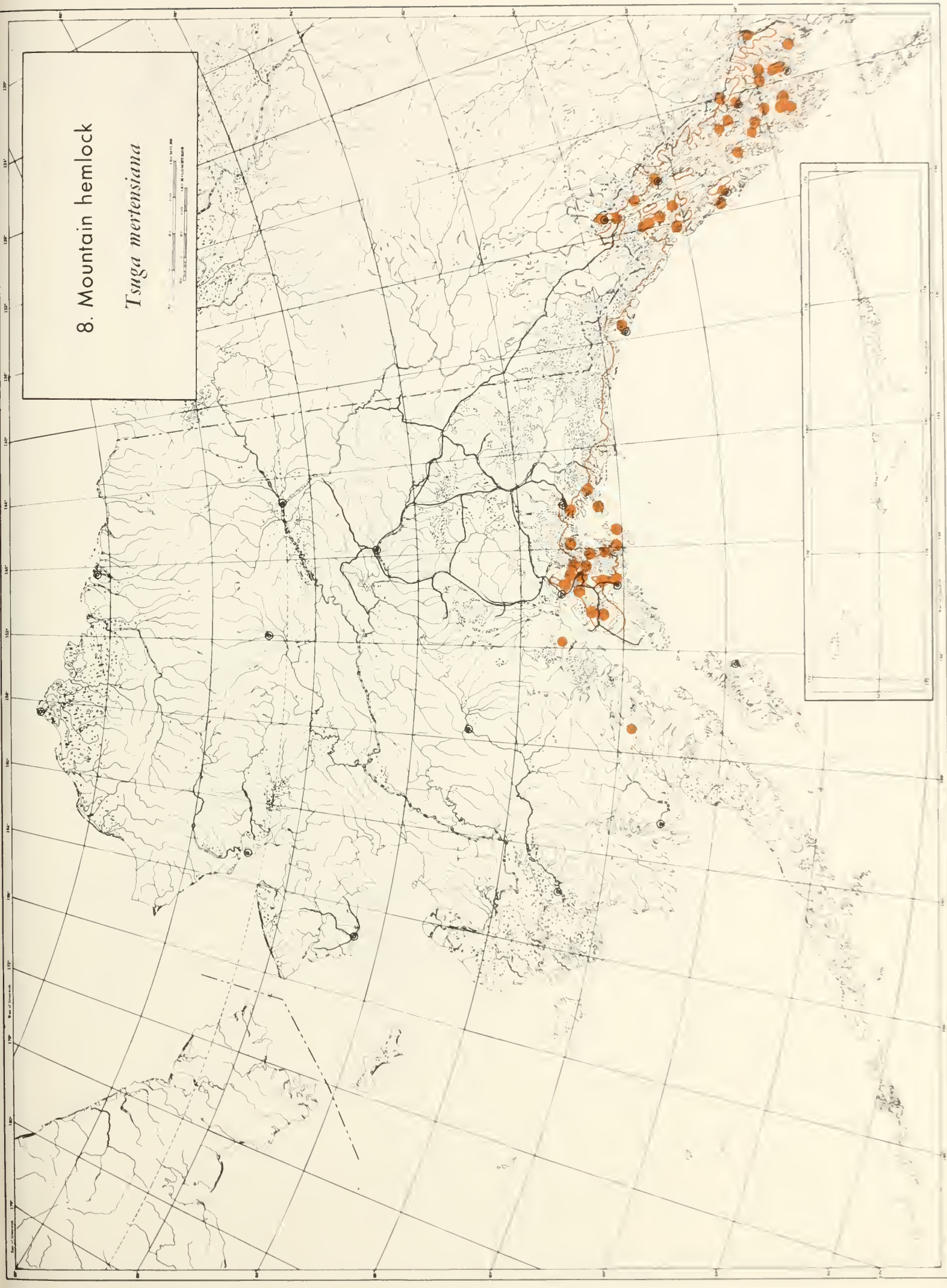
7. Western hemlock

Tsuga heterophylla

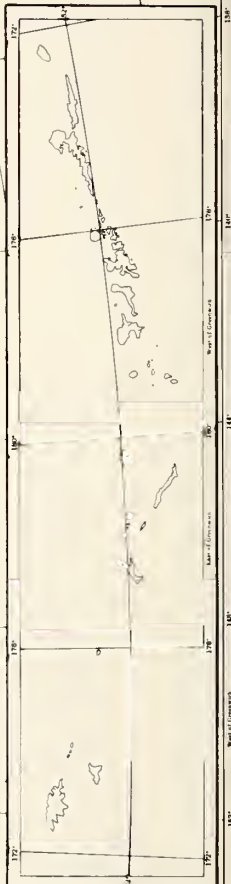
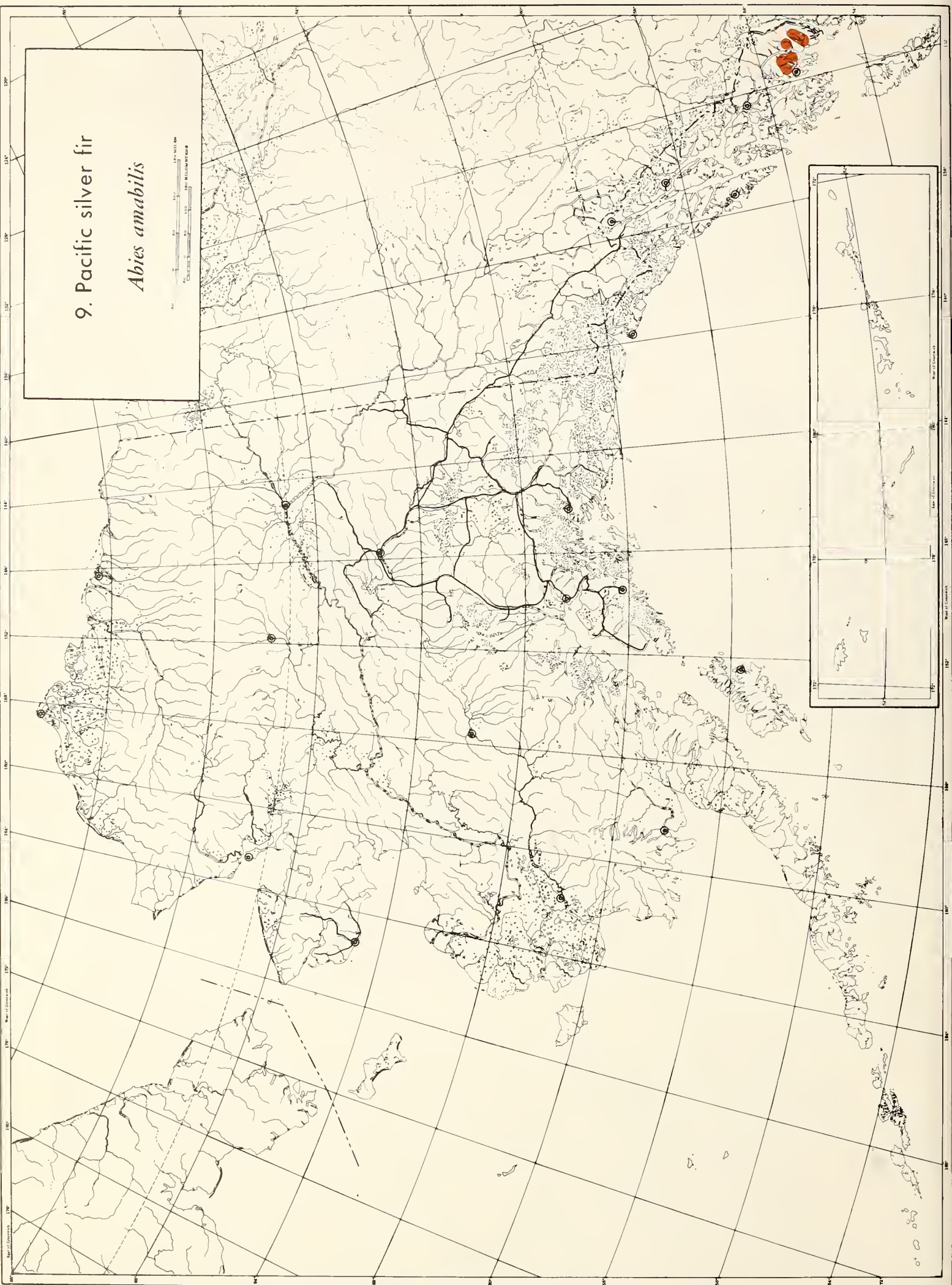


8. Mountain hemlock

Tsuga mertensiana

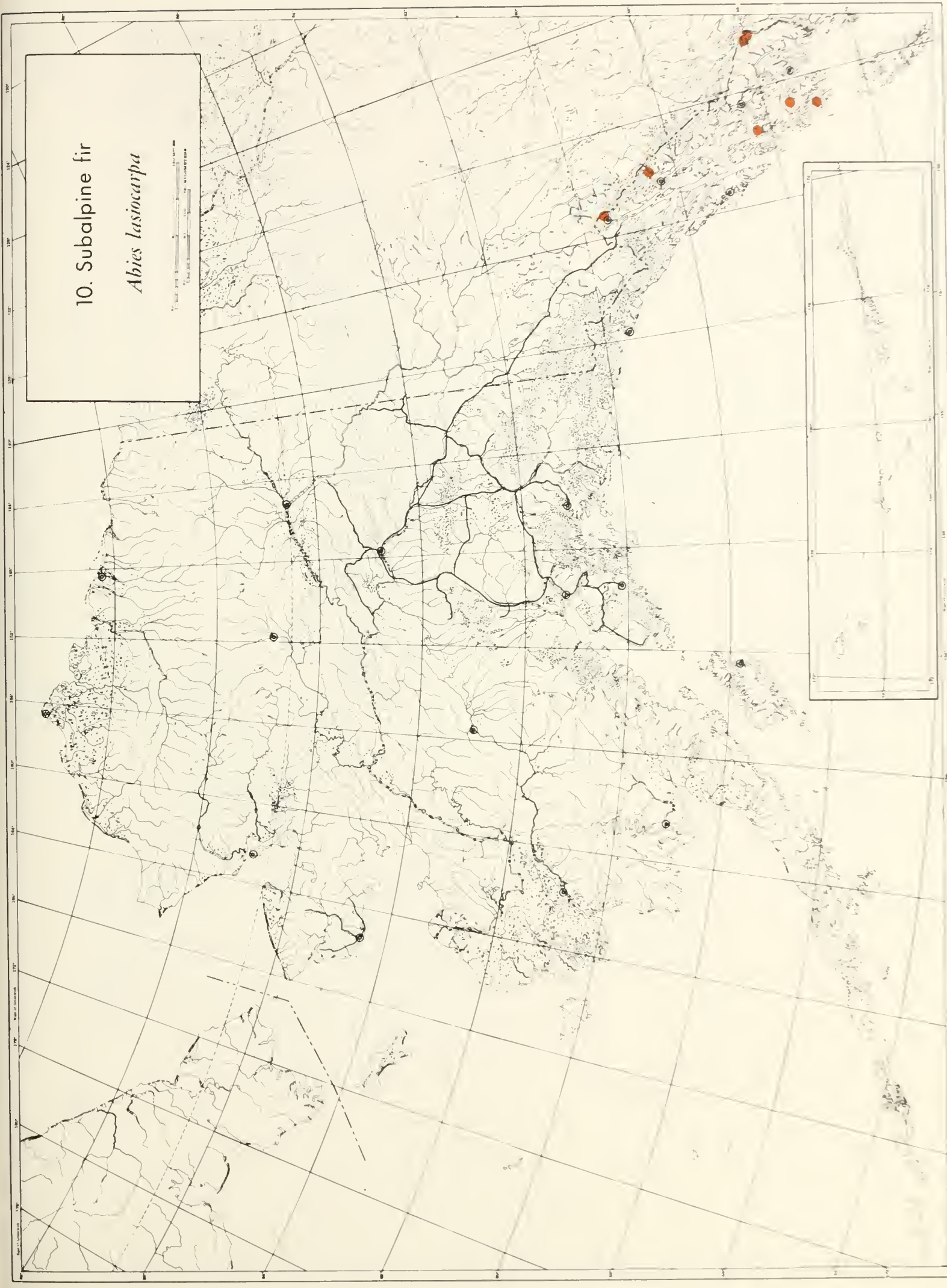
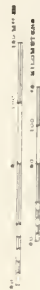


9. Pacific silver fir
Abies amabilis



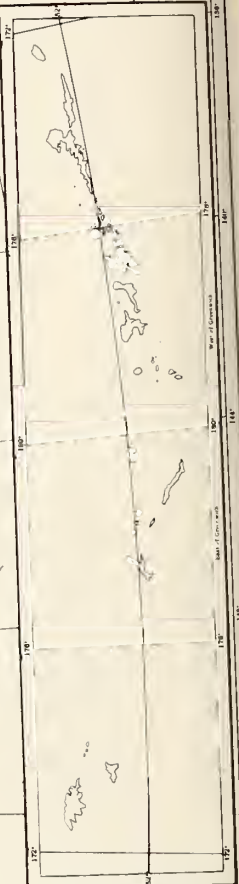
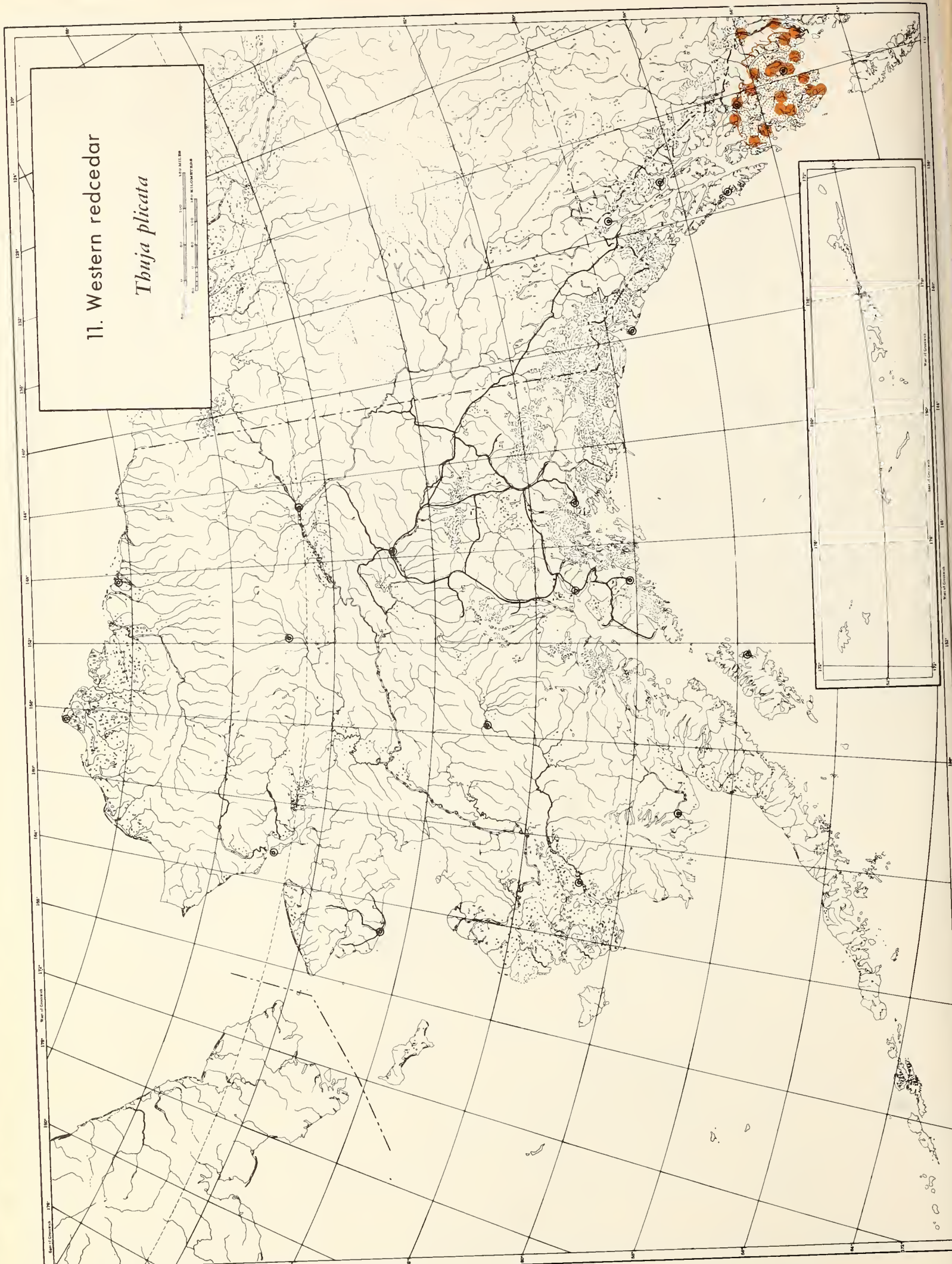
10. Subalpine fir

Abies lasiocarpa

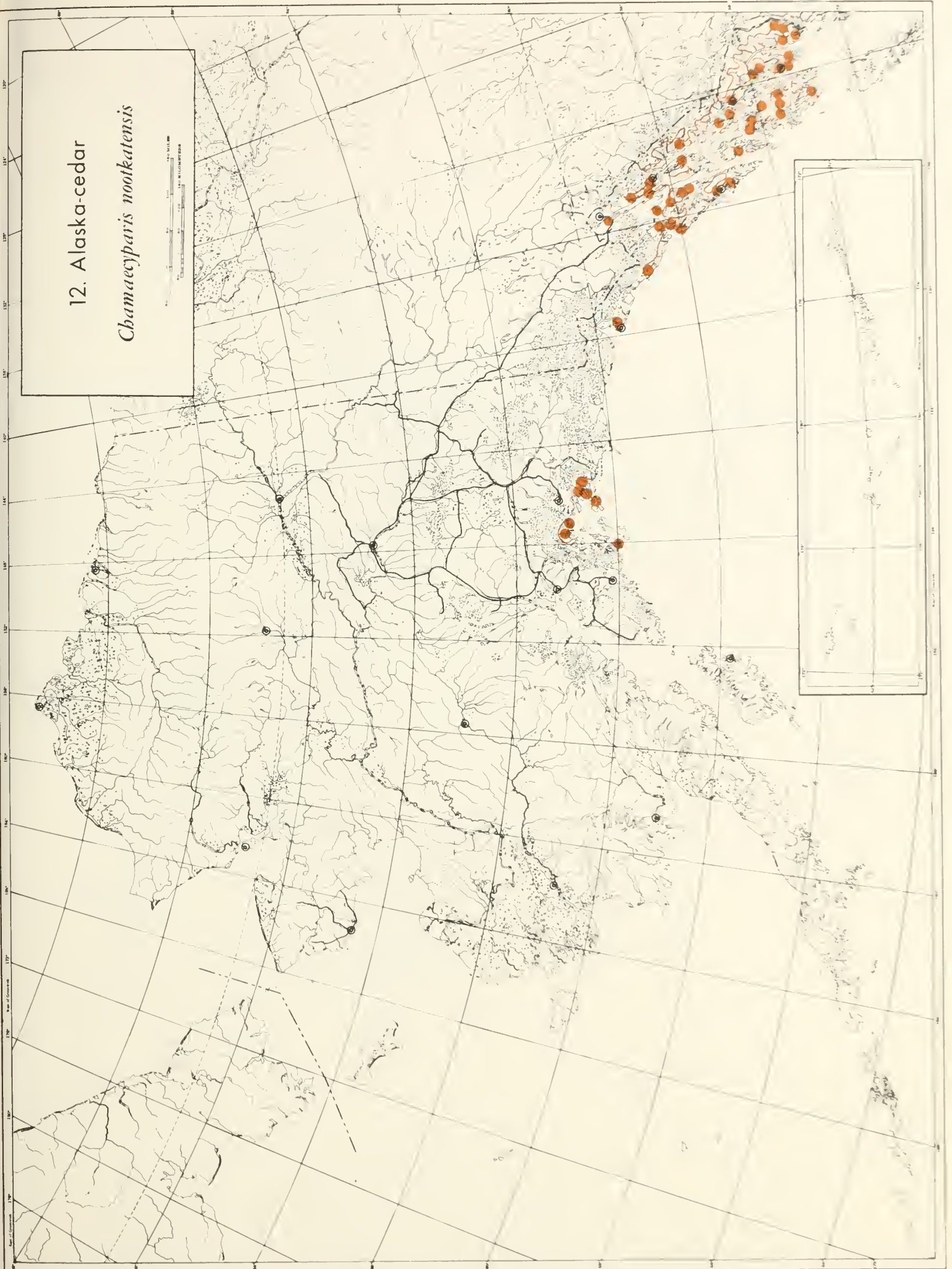


11. Western redcedar

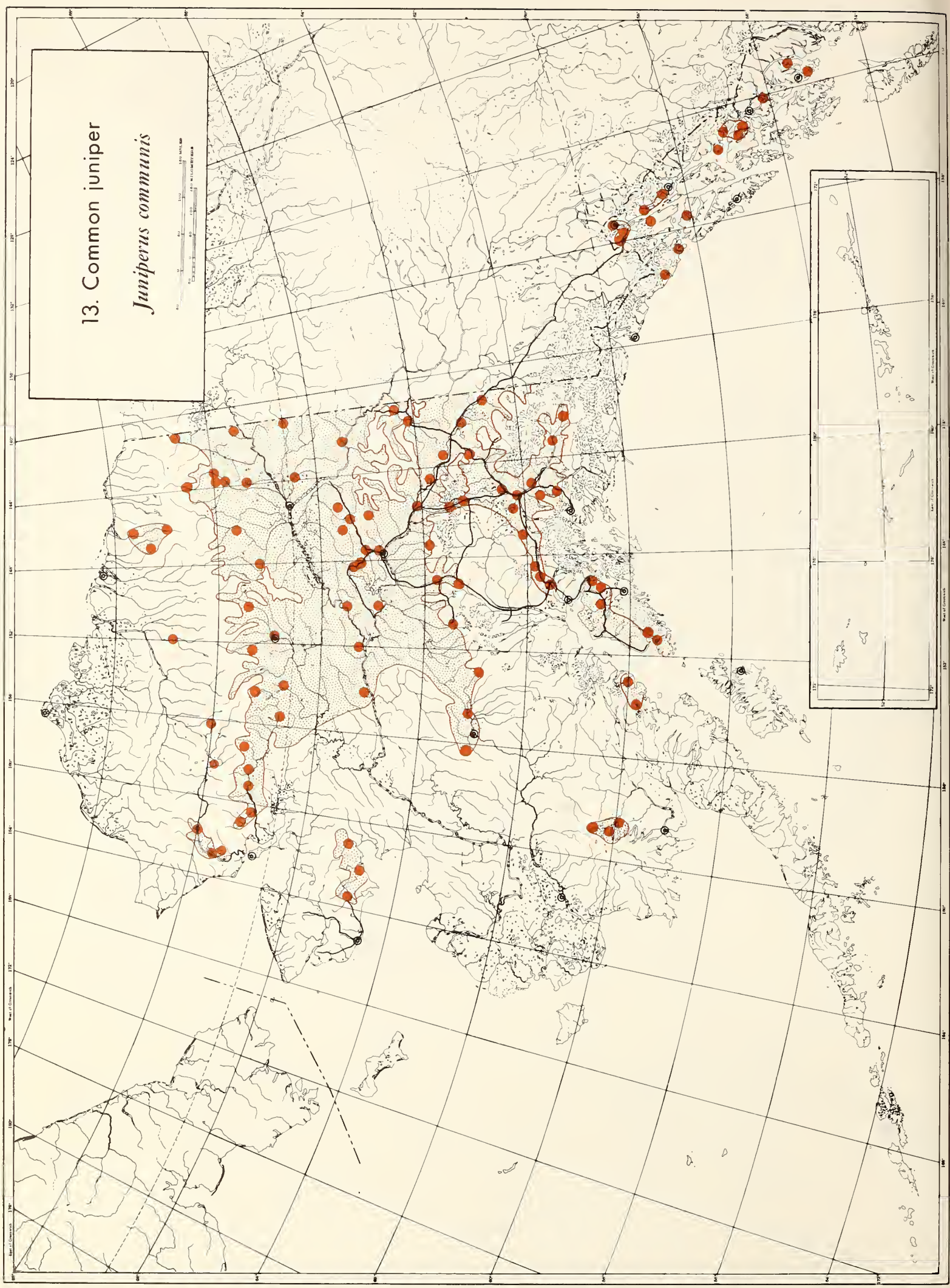
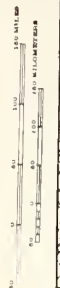
Thuja plicata



12. Alaska-cedar
Chamaecyparis nootkatensis

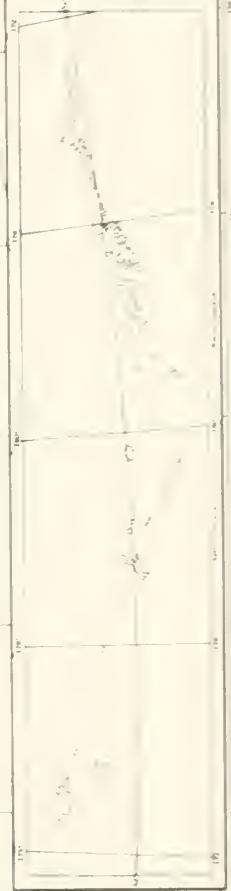
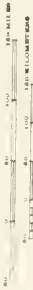


13. Common juniper
Juniperus communis

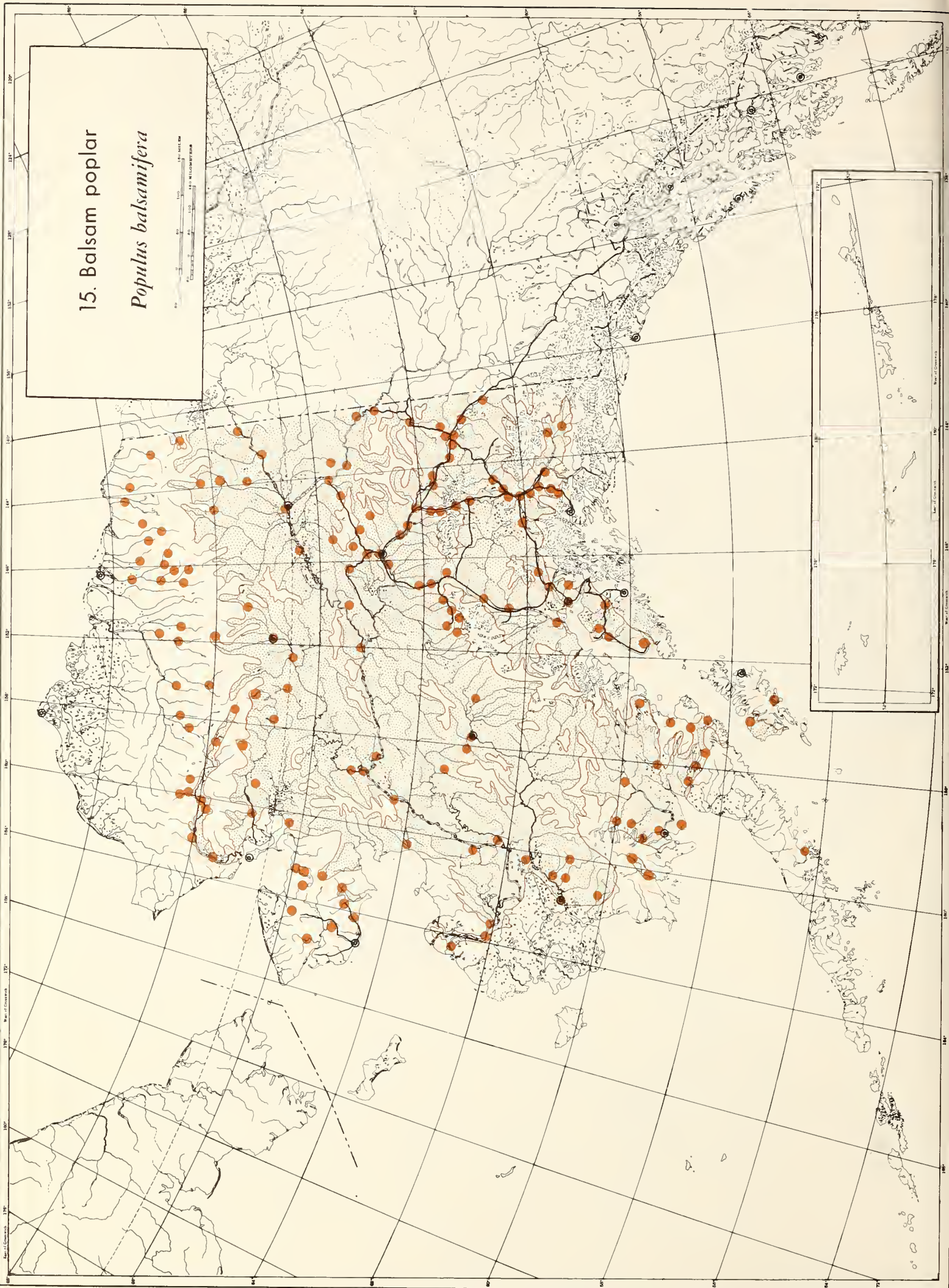


14. Creeping juniper

Juniperus horizontalis

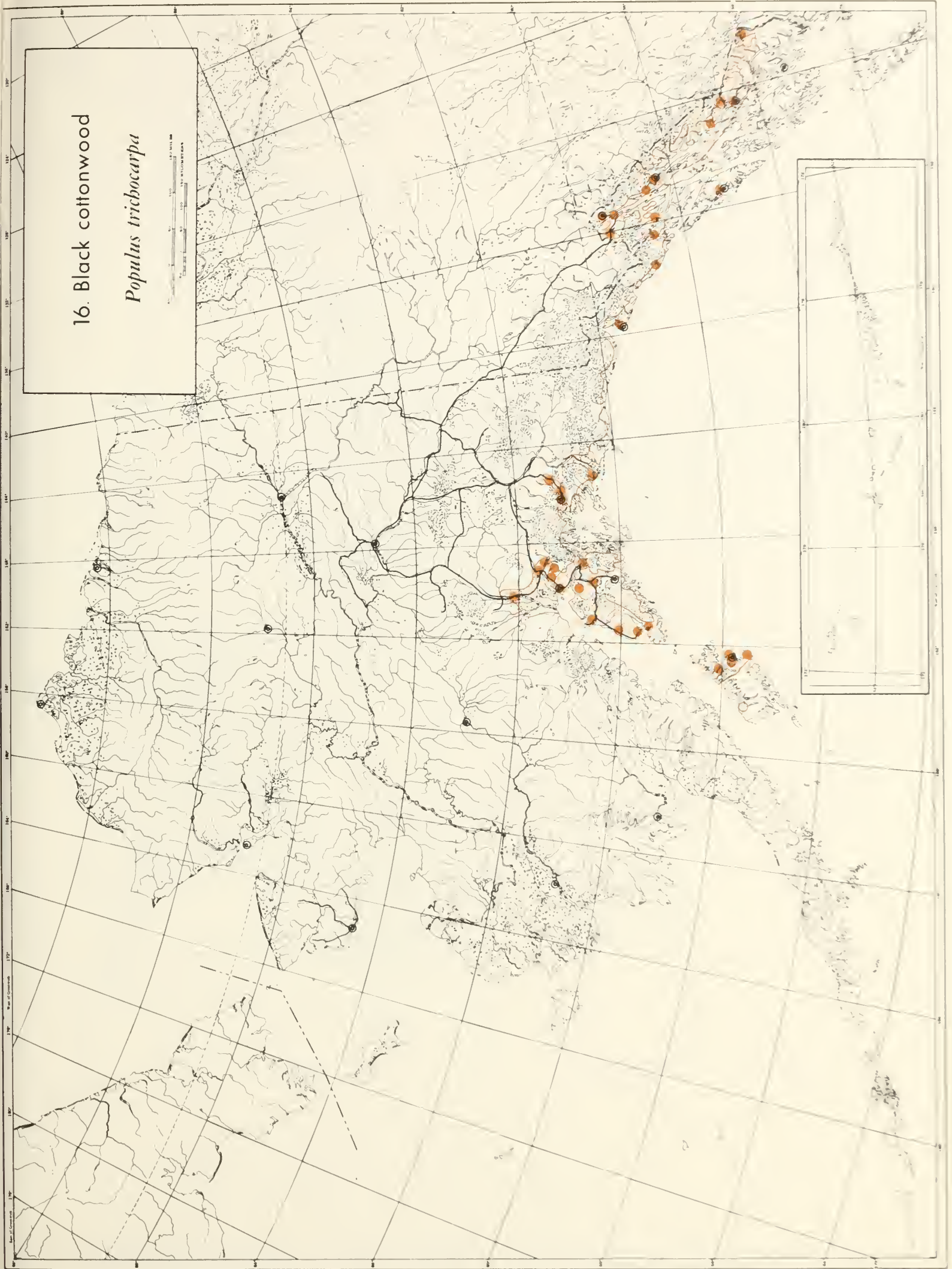


15. Balsam poplar
Populus balsamifera



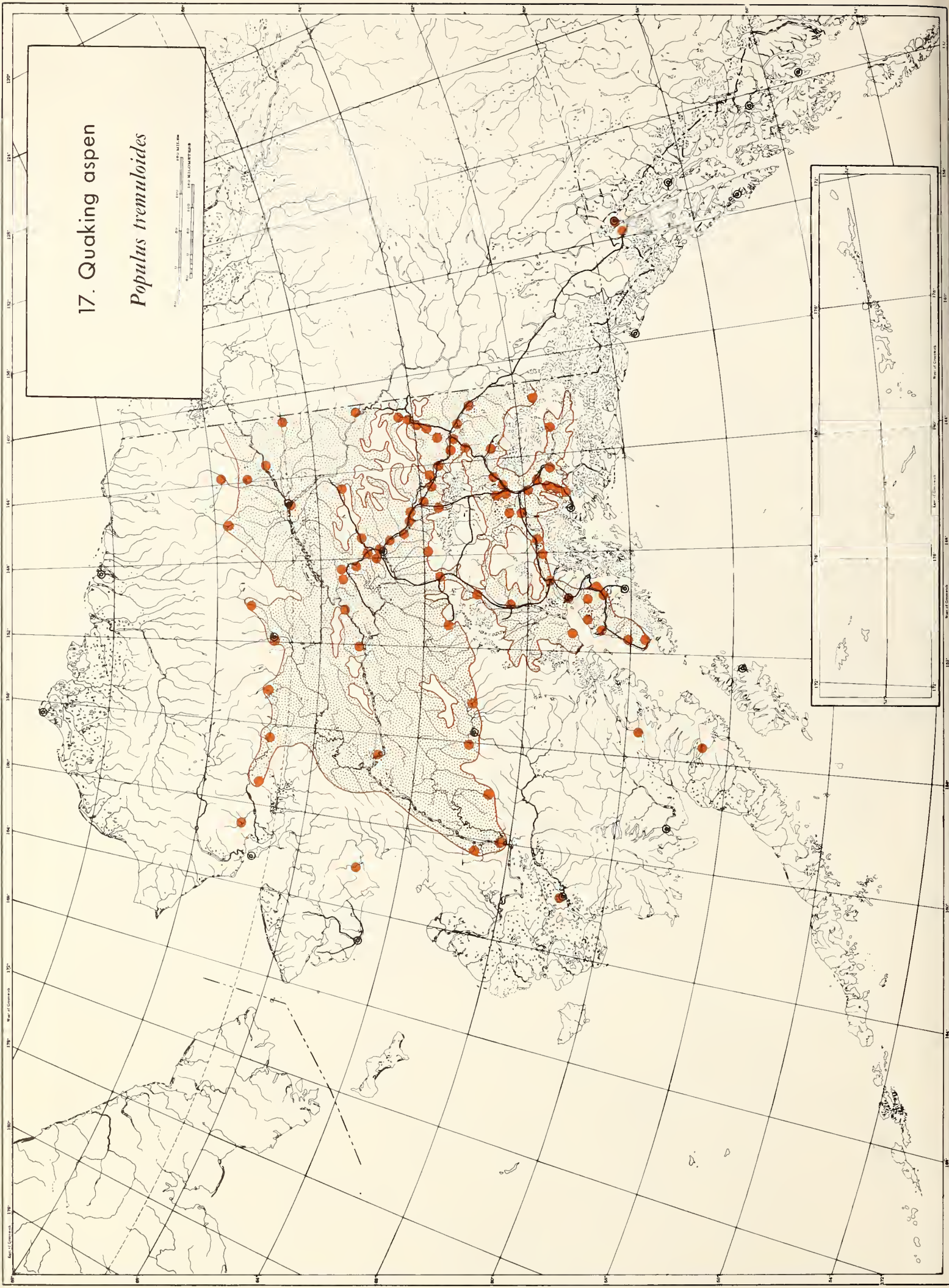
16. Black cottonwood

Populus trichocarpa



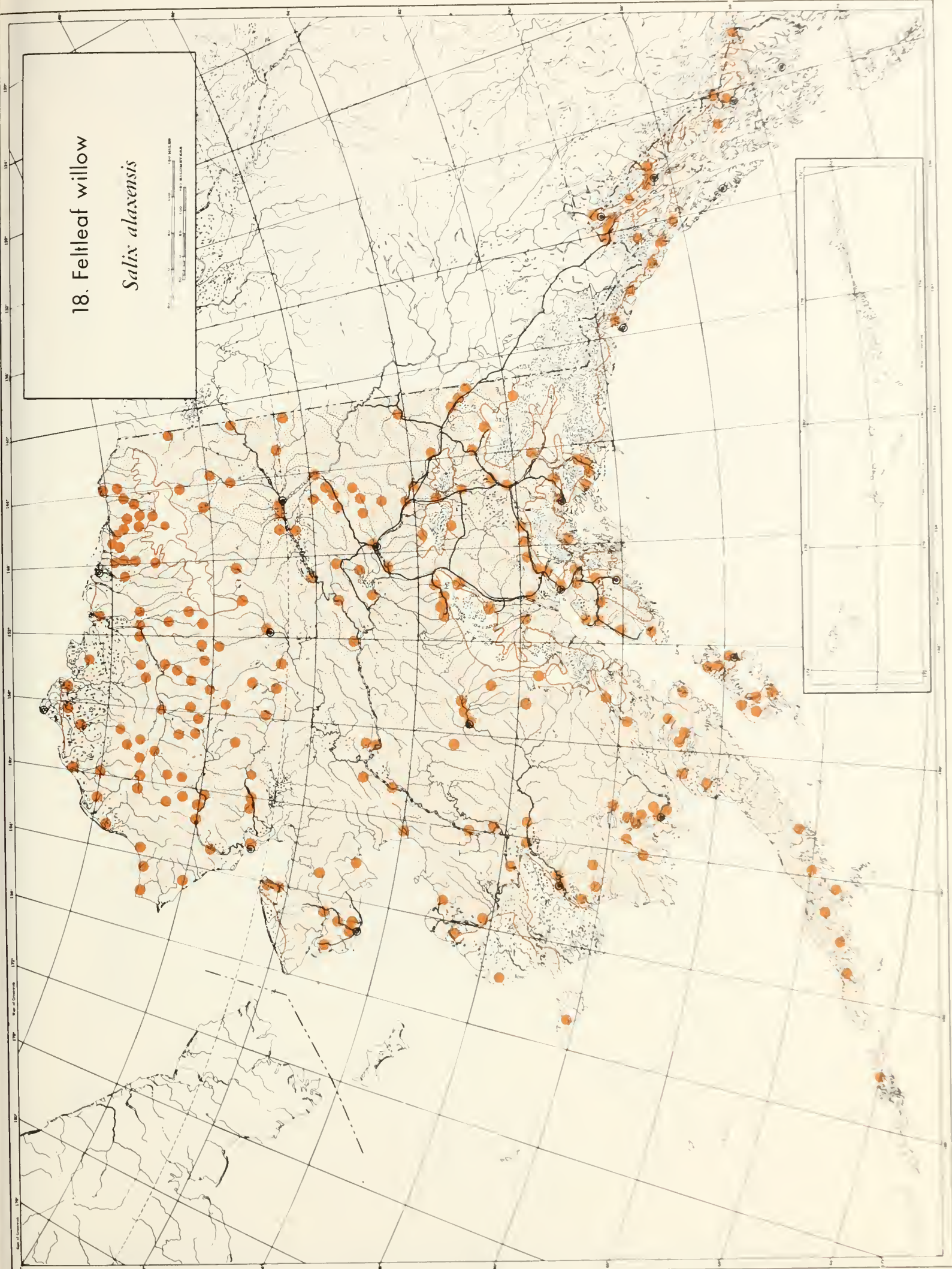
17. Quaking aspen

Populus tremuloides



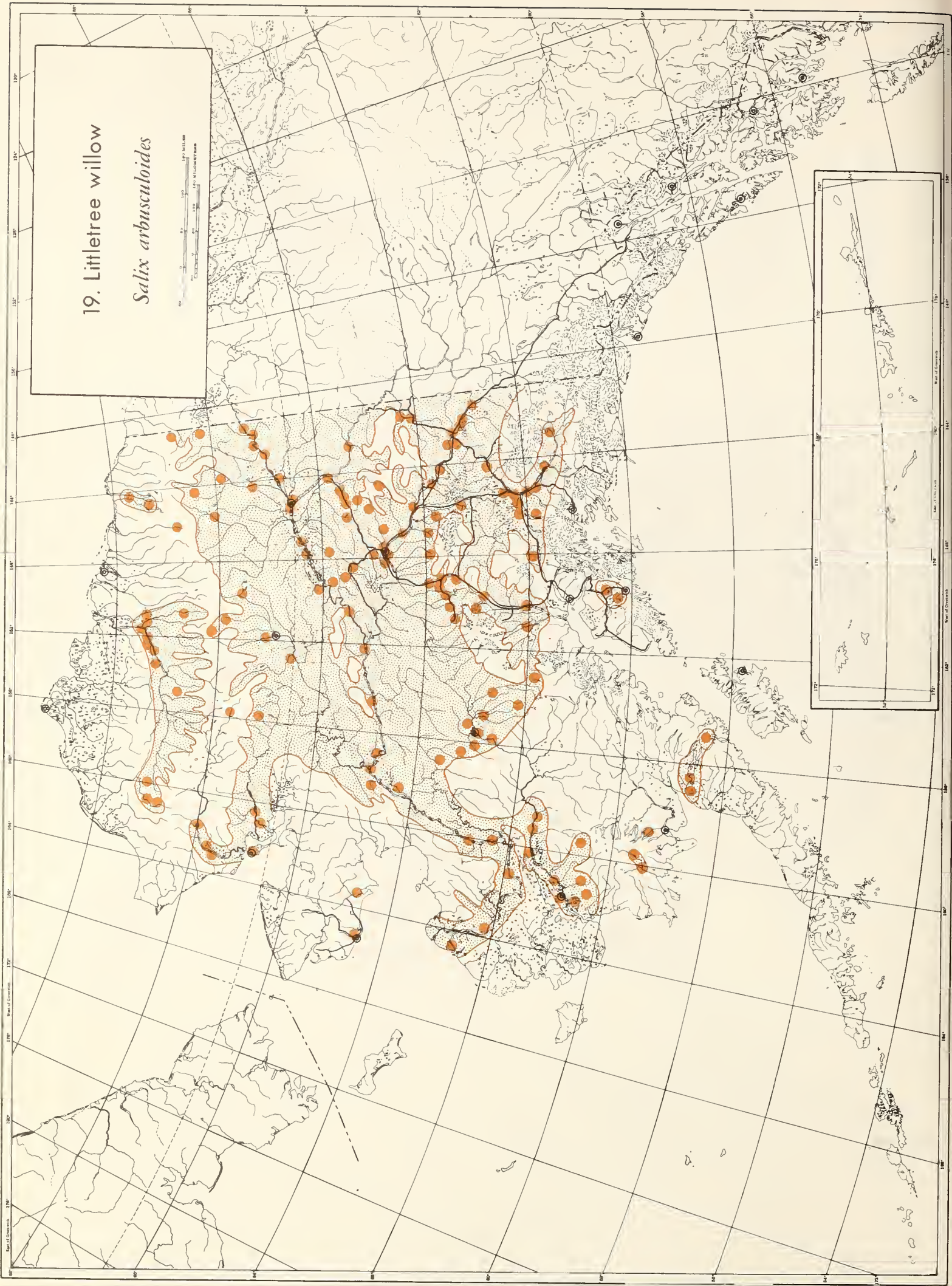
18. Feltleaf willow

Salix alaxensis



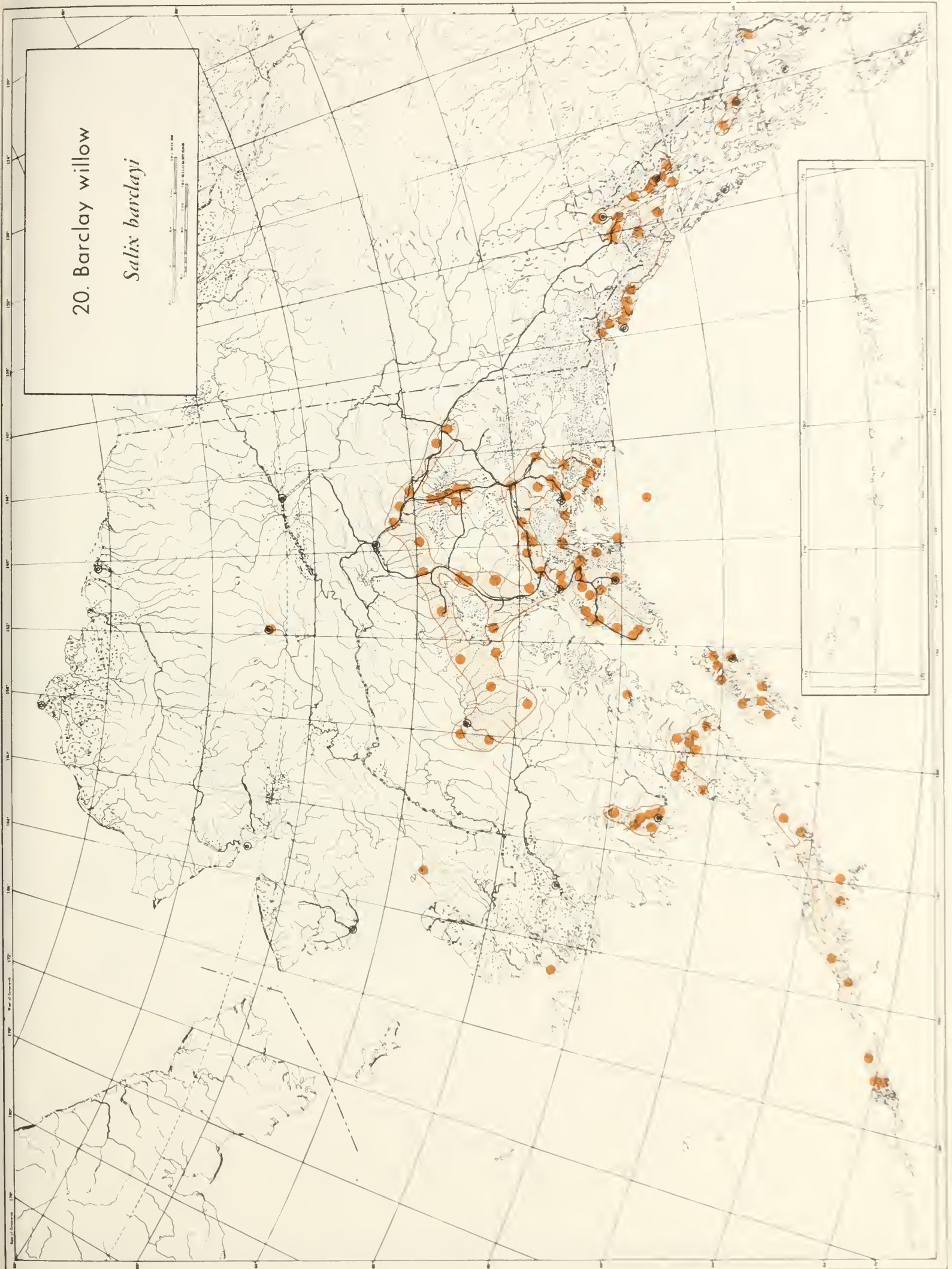
19. Littletree willow

Salix arbusculoides



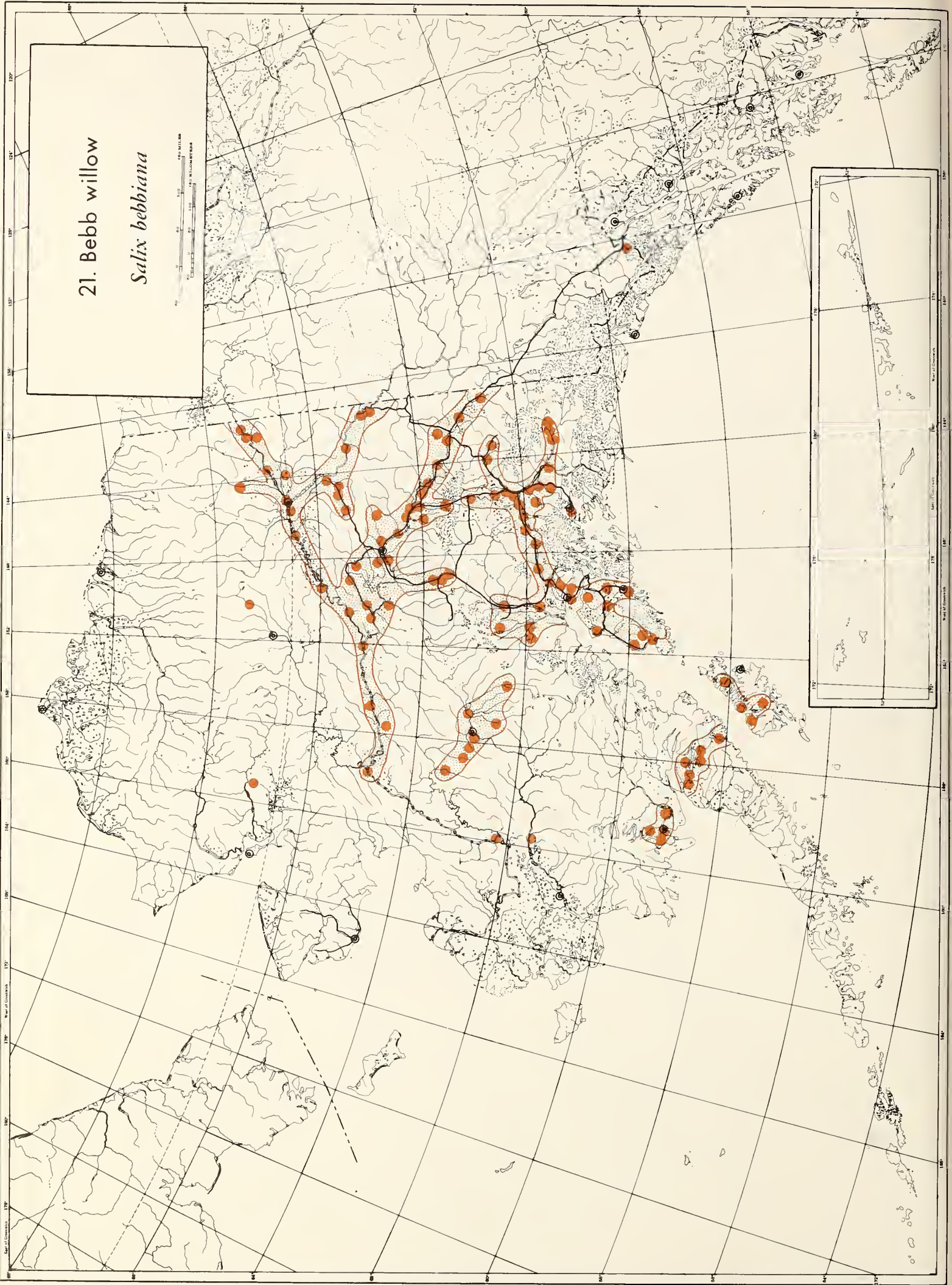
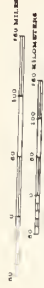
20. Barclay willow

Salix barclayi



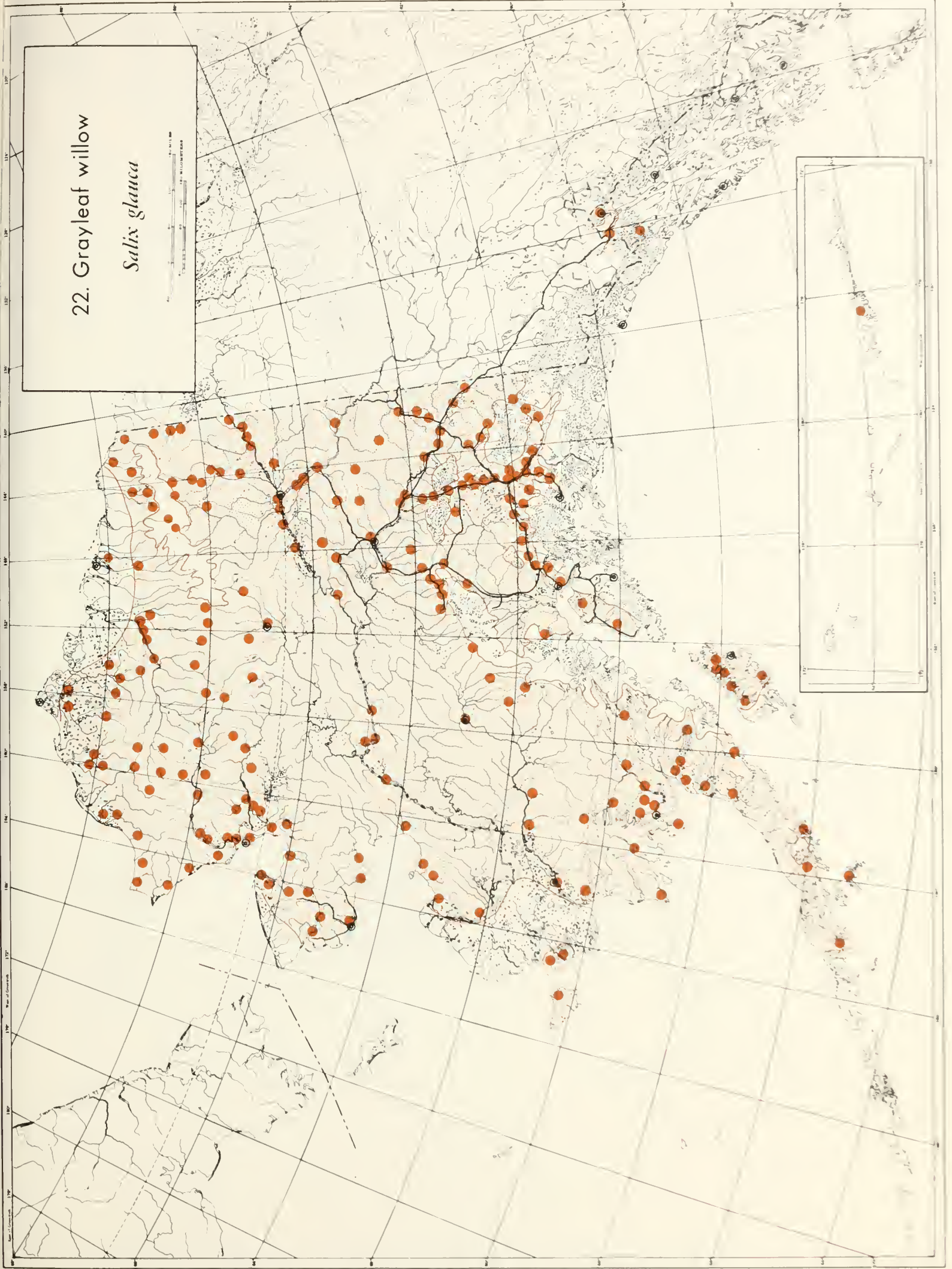
21. Bebb willow

Salix bebbiana



22. Grayleaf willow

Salix glauca



23. Hooker willow

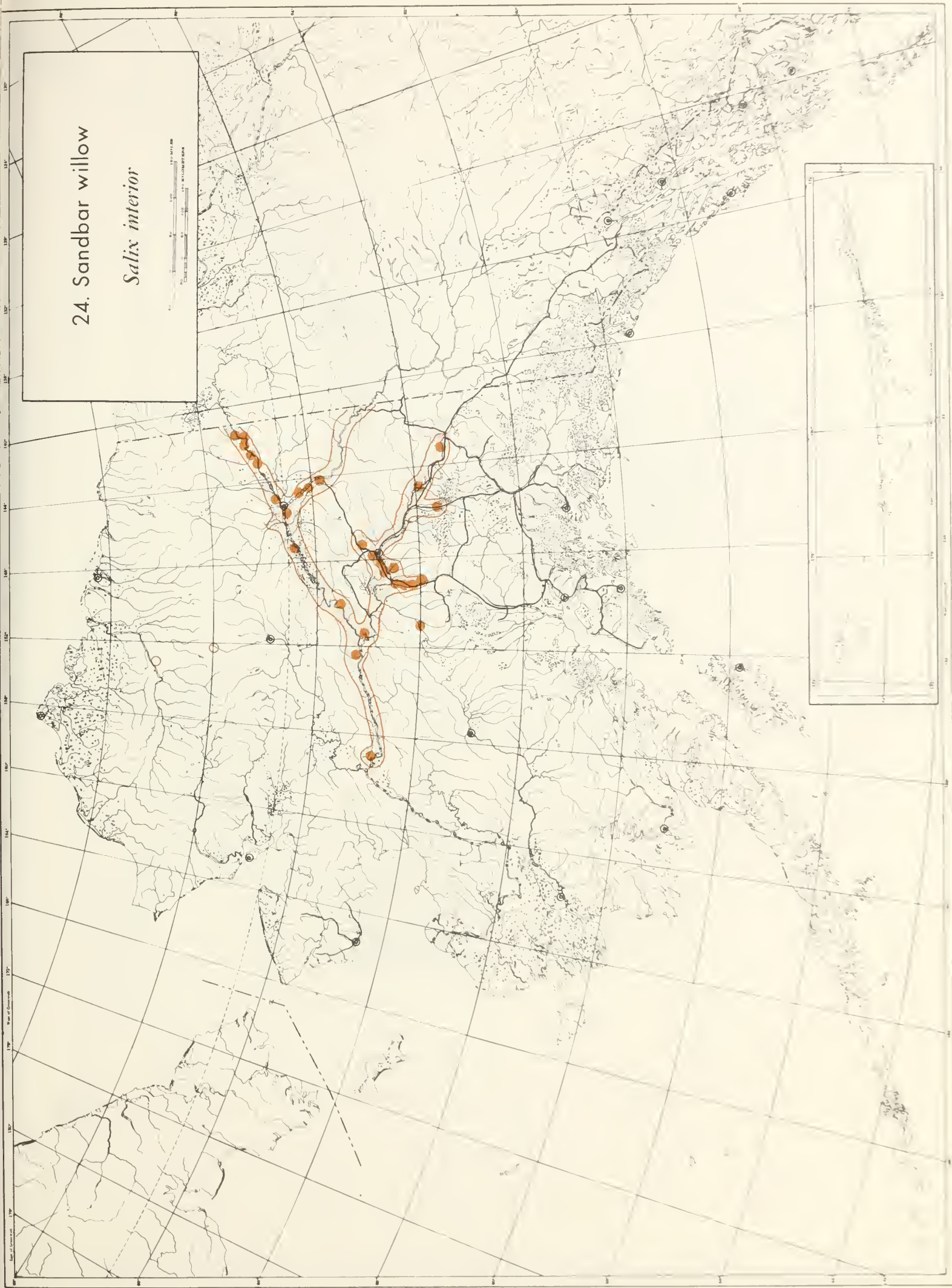
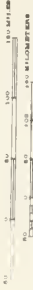
Salix hookeriana

1:50,000 METERS
1:100,000 KILOMETERS

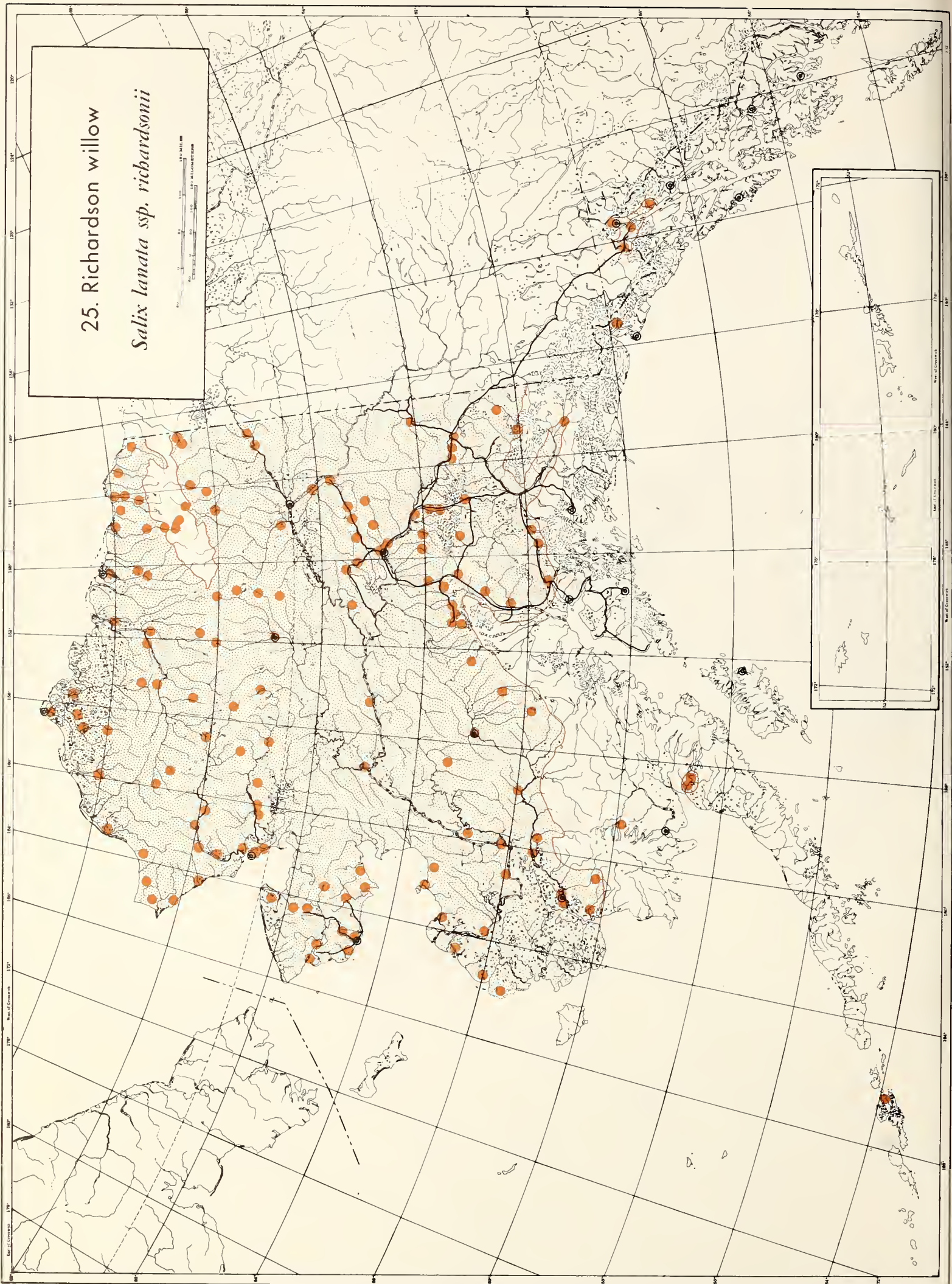


24. Sandbar willow

Salix interior

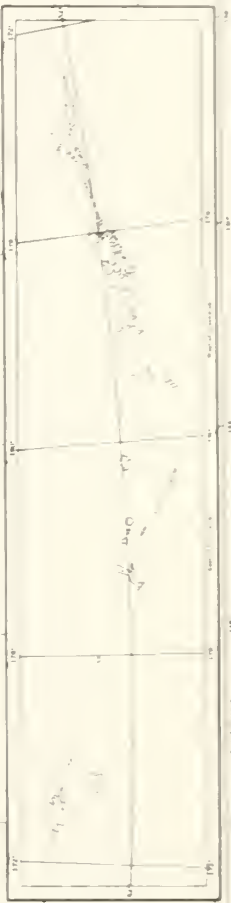
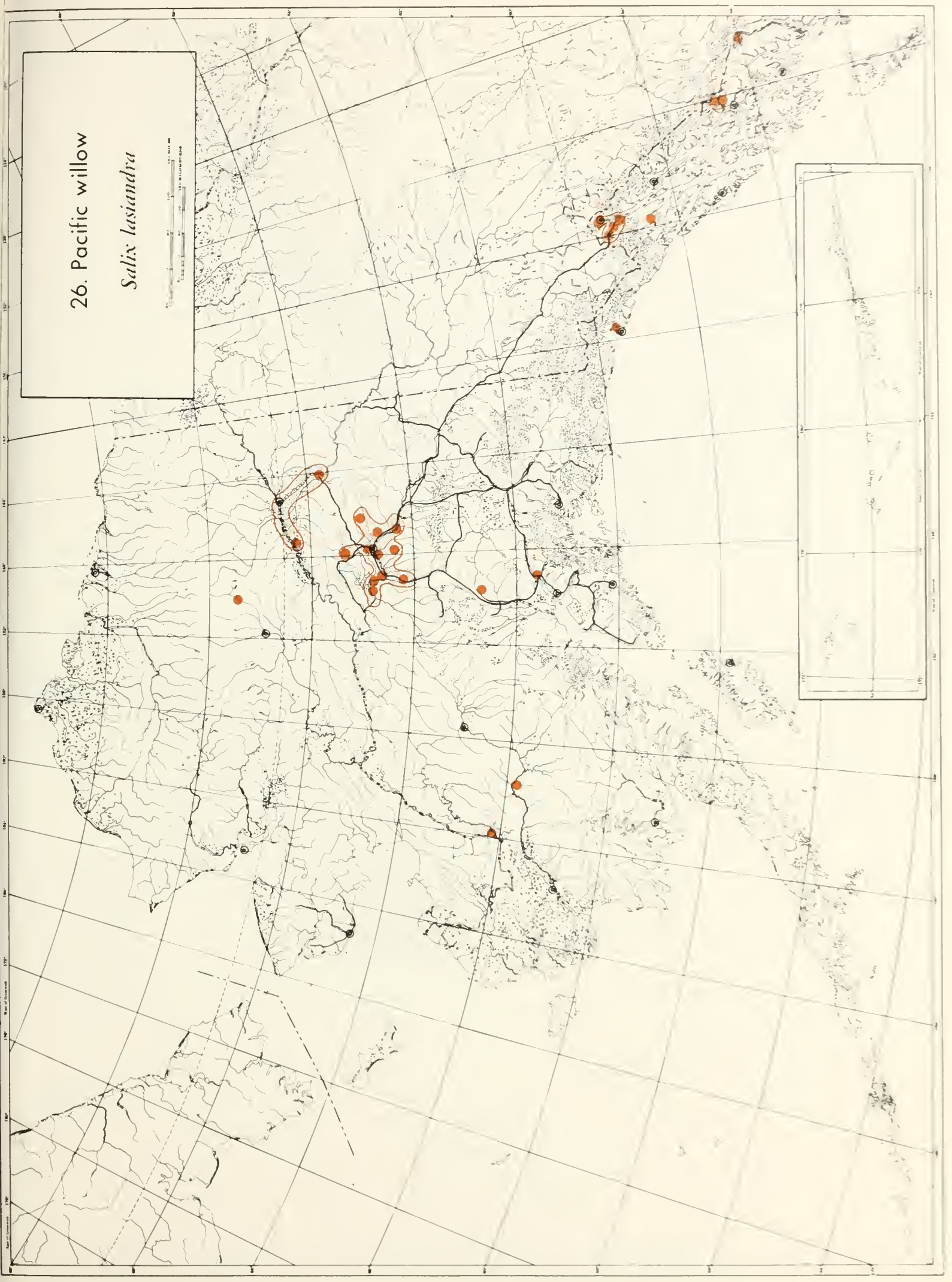


25. Richardson willow
Salix lanata ssp. *richardsonii*



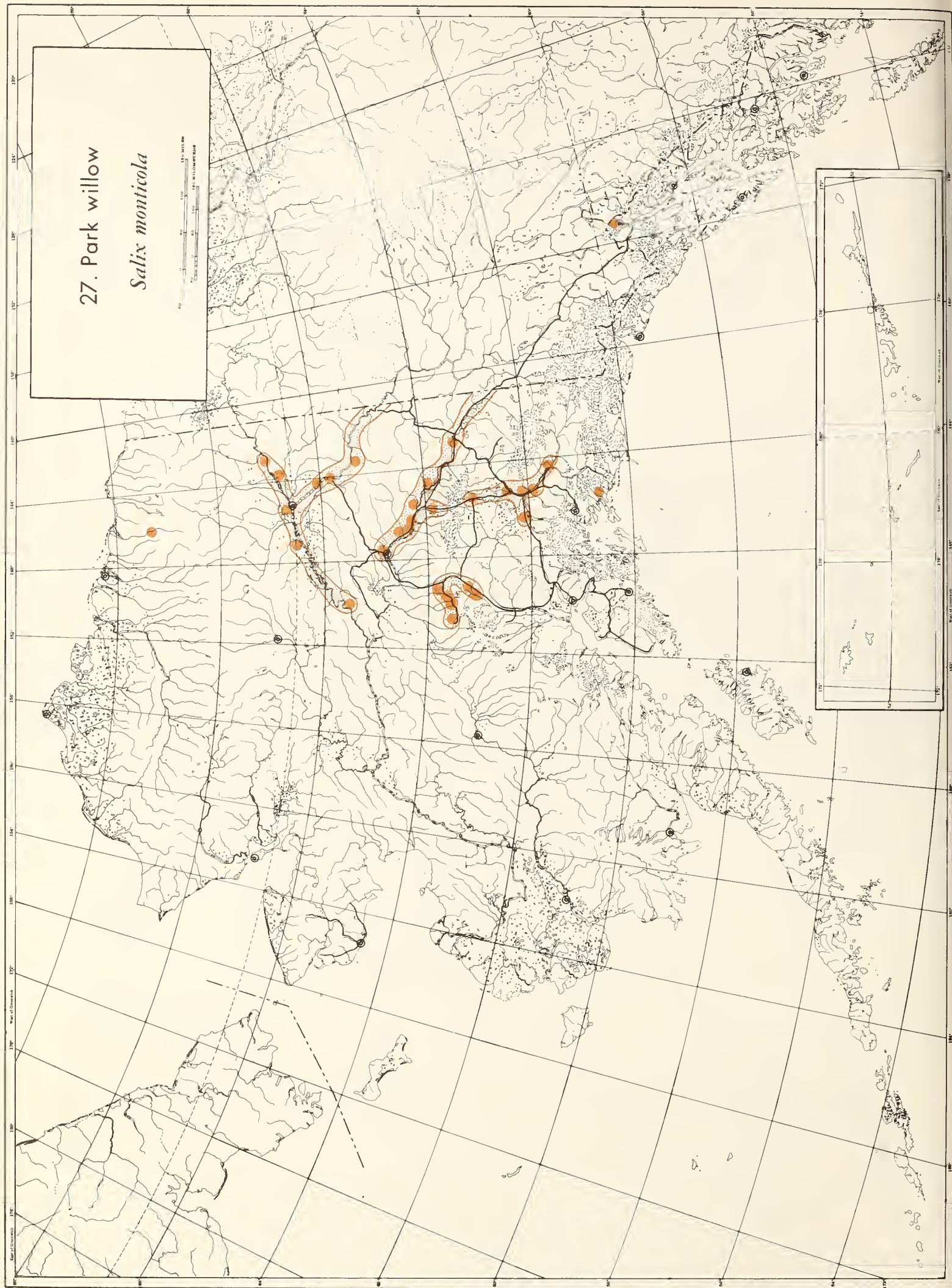
26. Pacific willow

Salix lasiandra



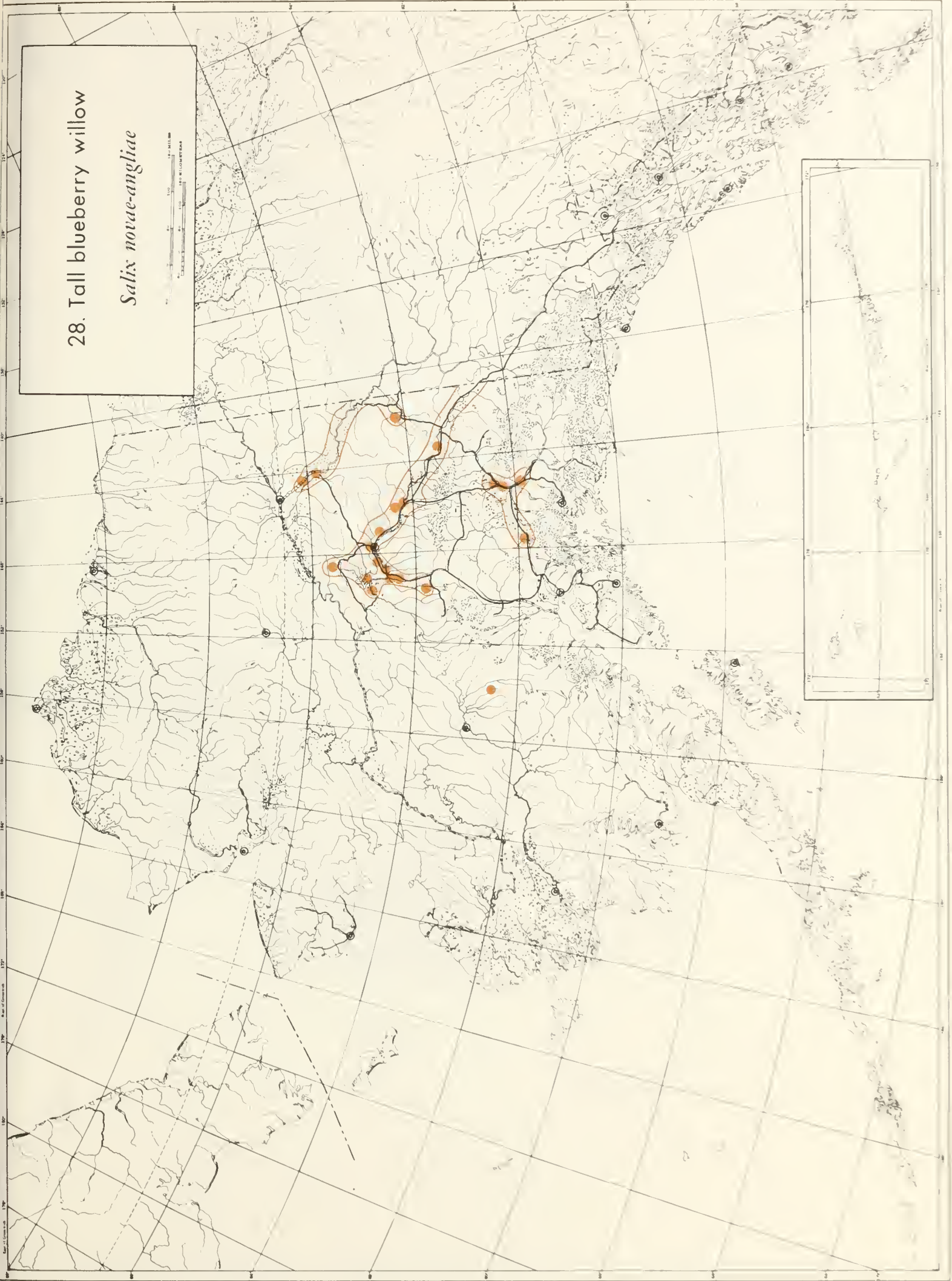
27. Park willow

Salix monticola



28. Tall blueberry willow

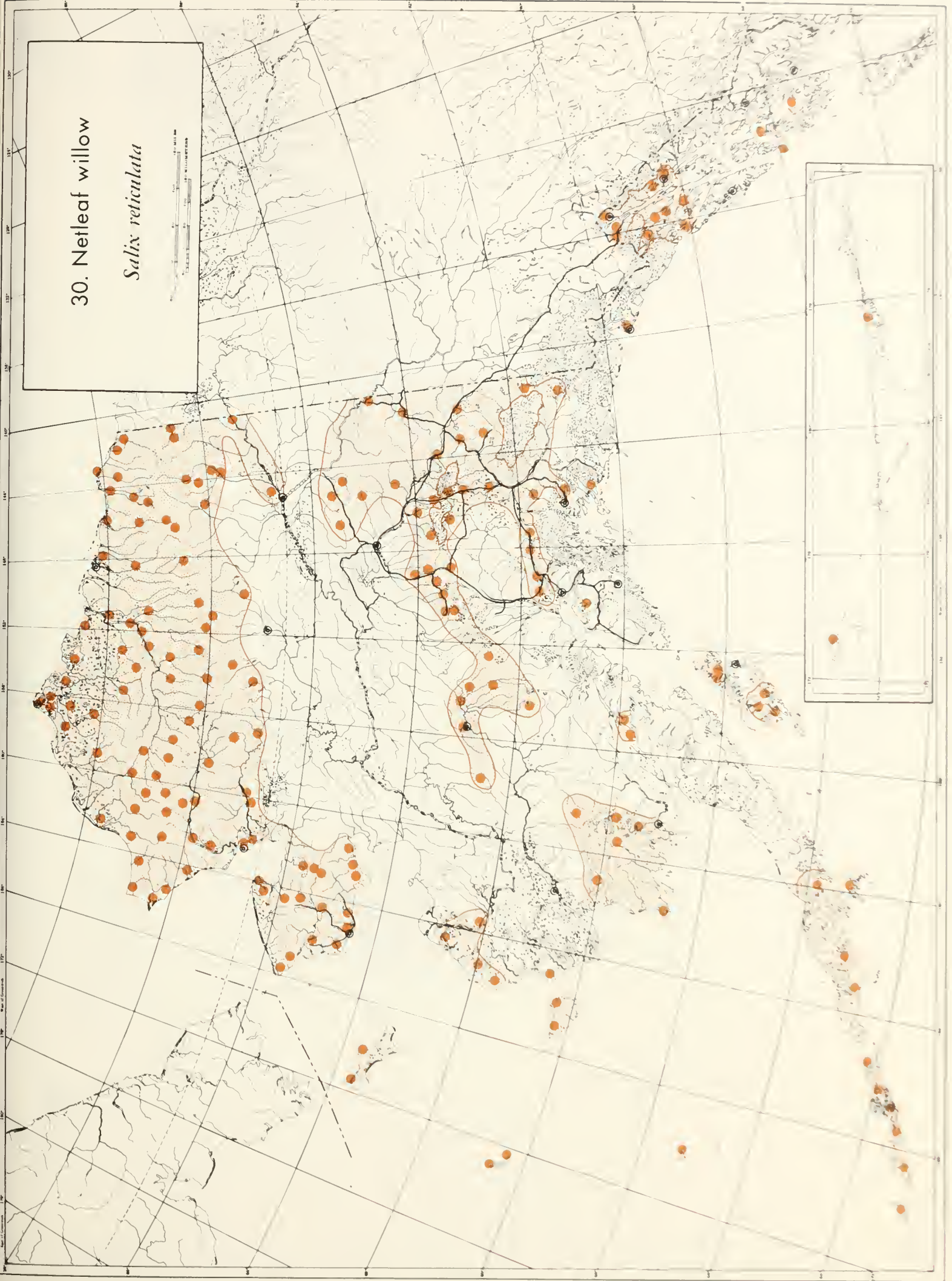
Salix norae-angliae



30. Netleaf willow

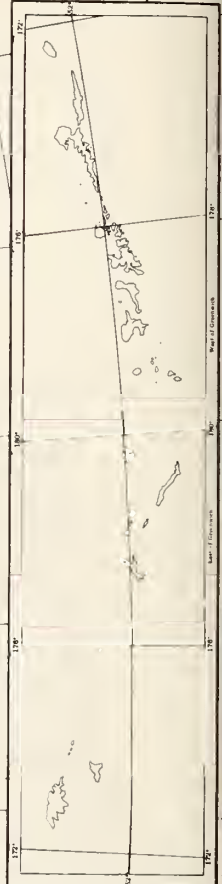
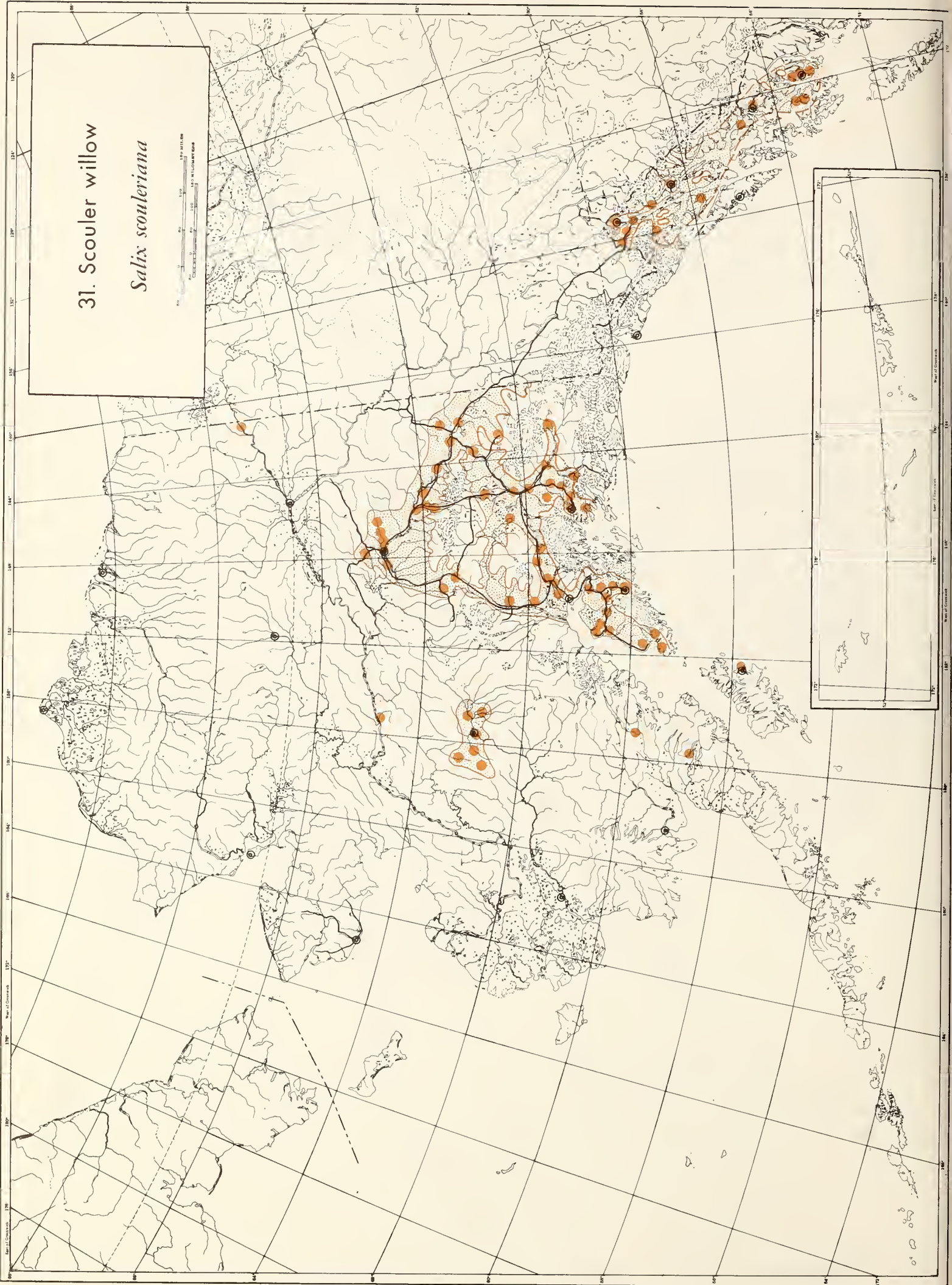
Salix reticulata

Scale bar: 0 100 200 Miles
0 100 200 Kilometers

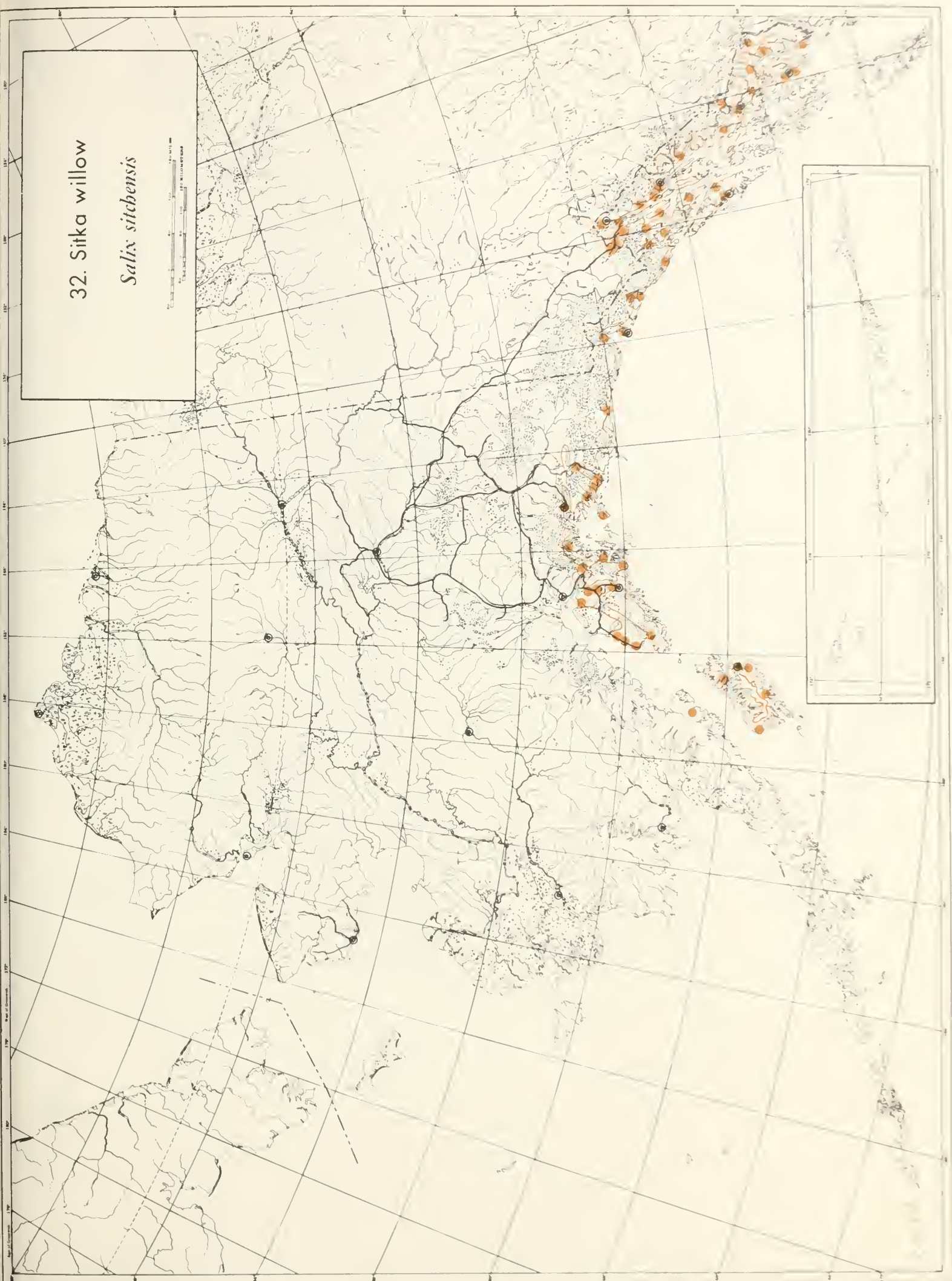


31. Scouler willow

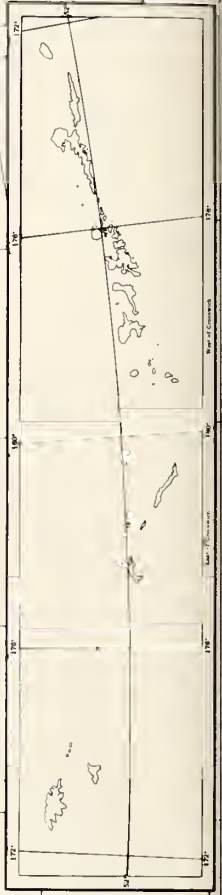
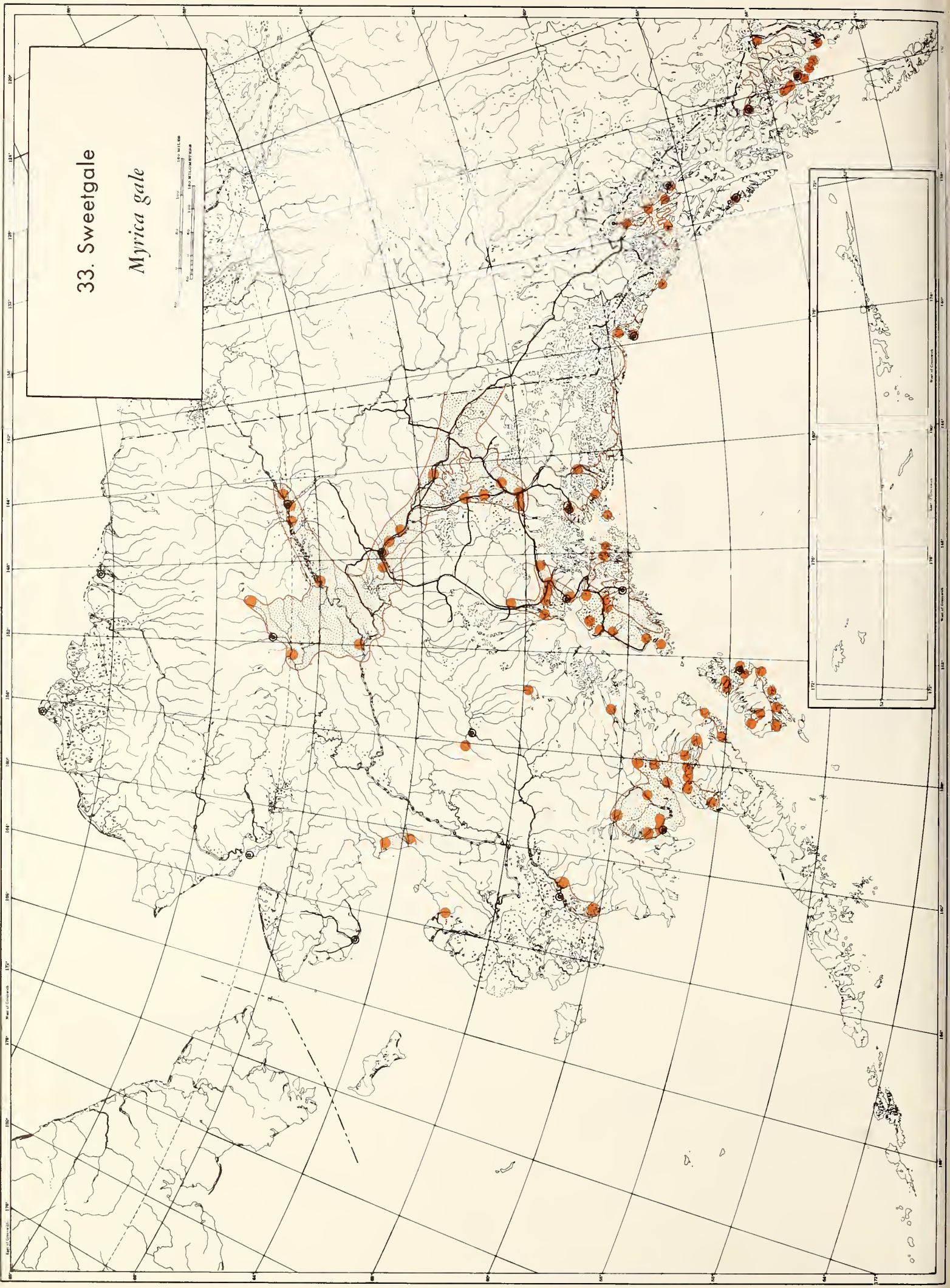
Salix scouleriana



32. Sitka willow
Salix sitcensis

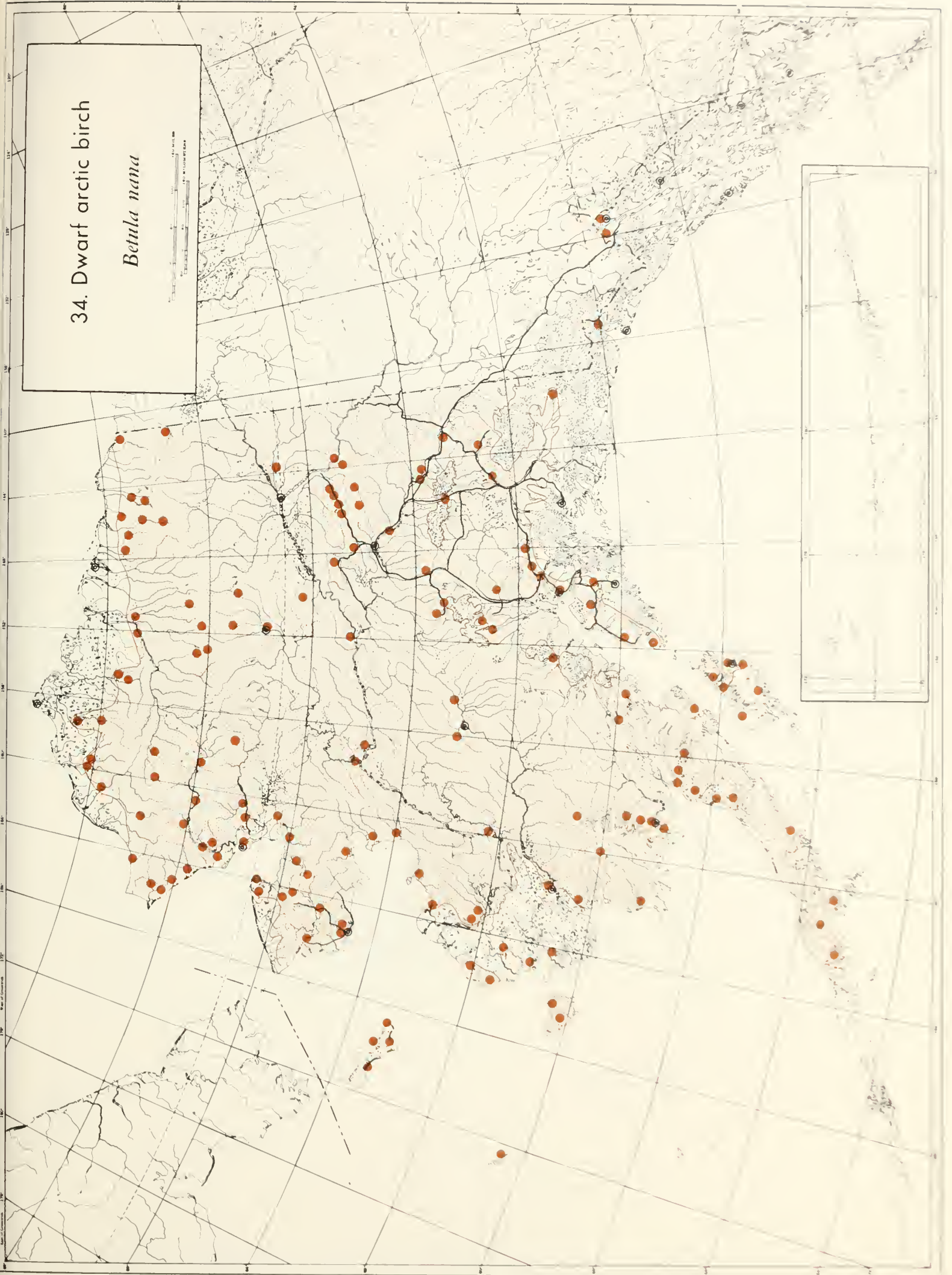
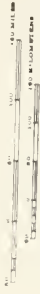


33. Sweetgale
Myrica gale



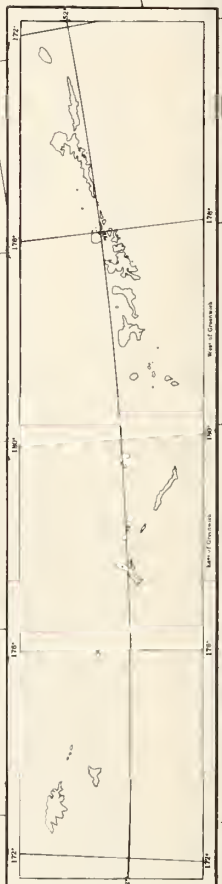
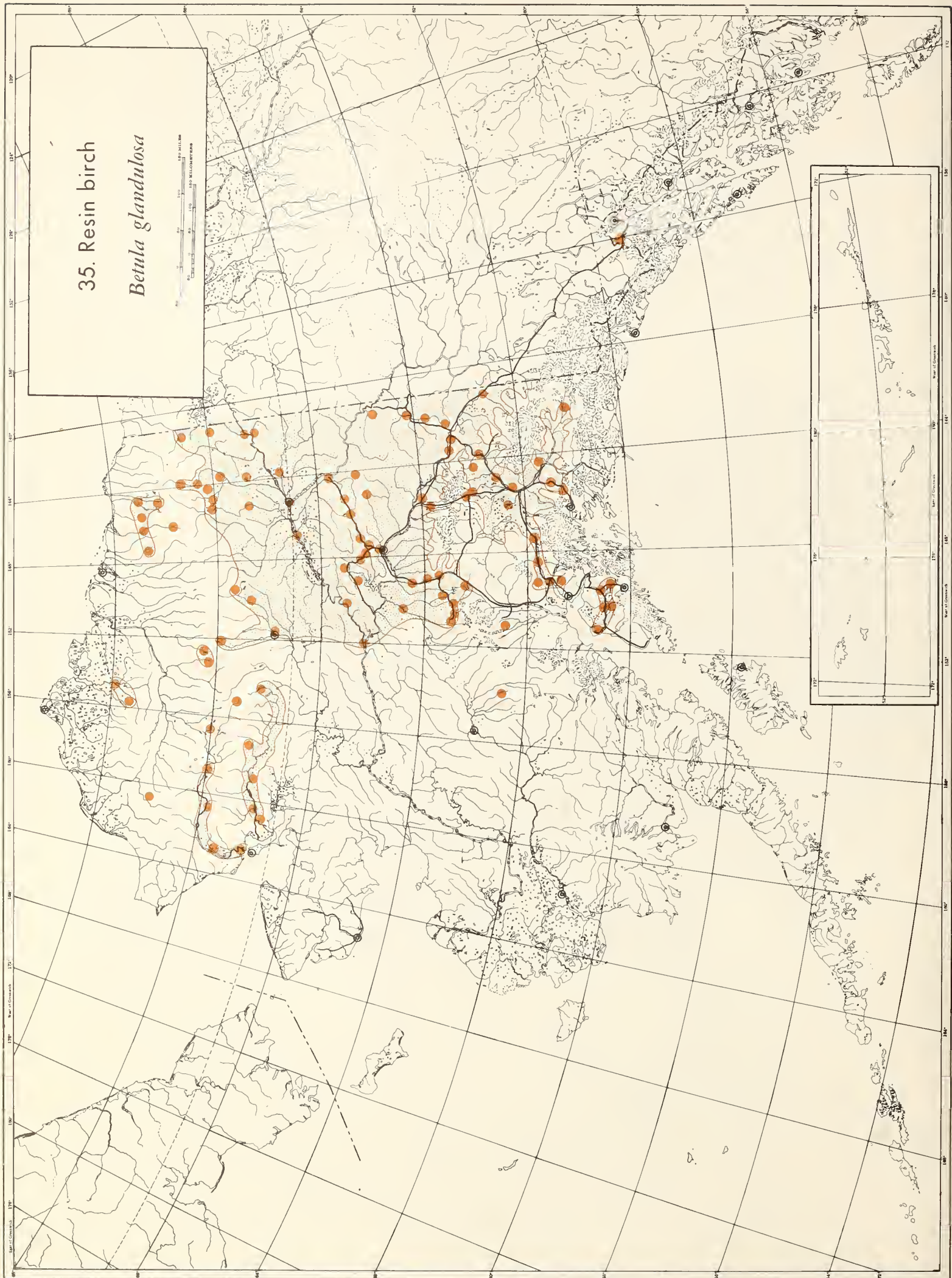
34. Dwarf arctic birch

Betula nana



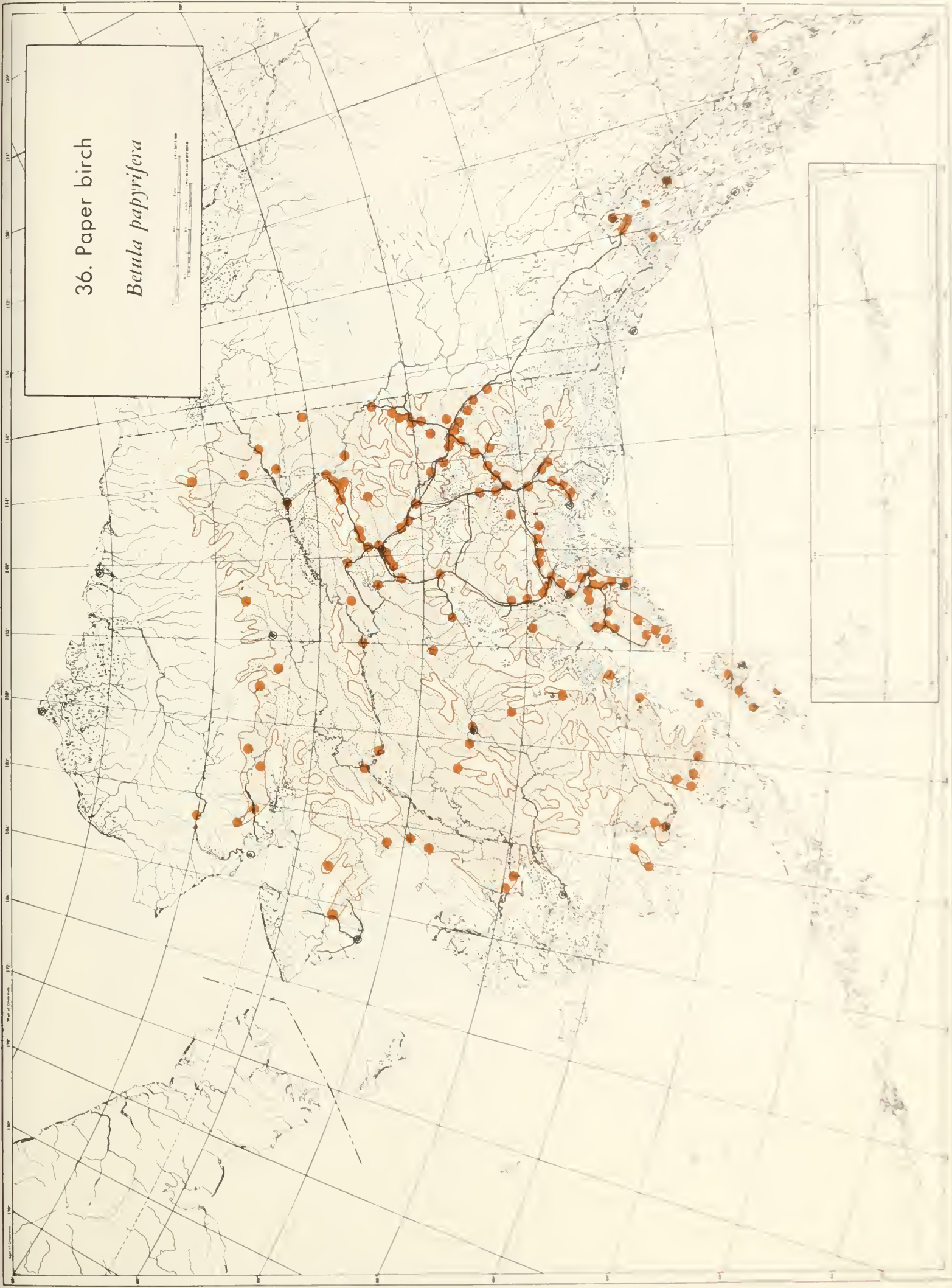
35. Resin birch

Betula glandulosa

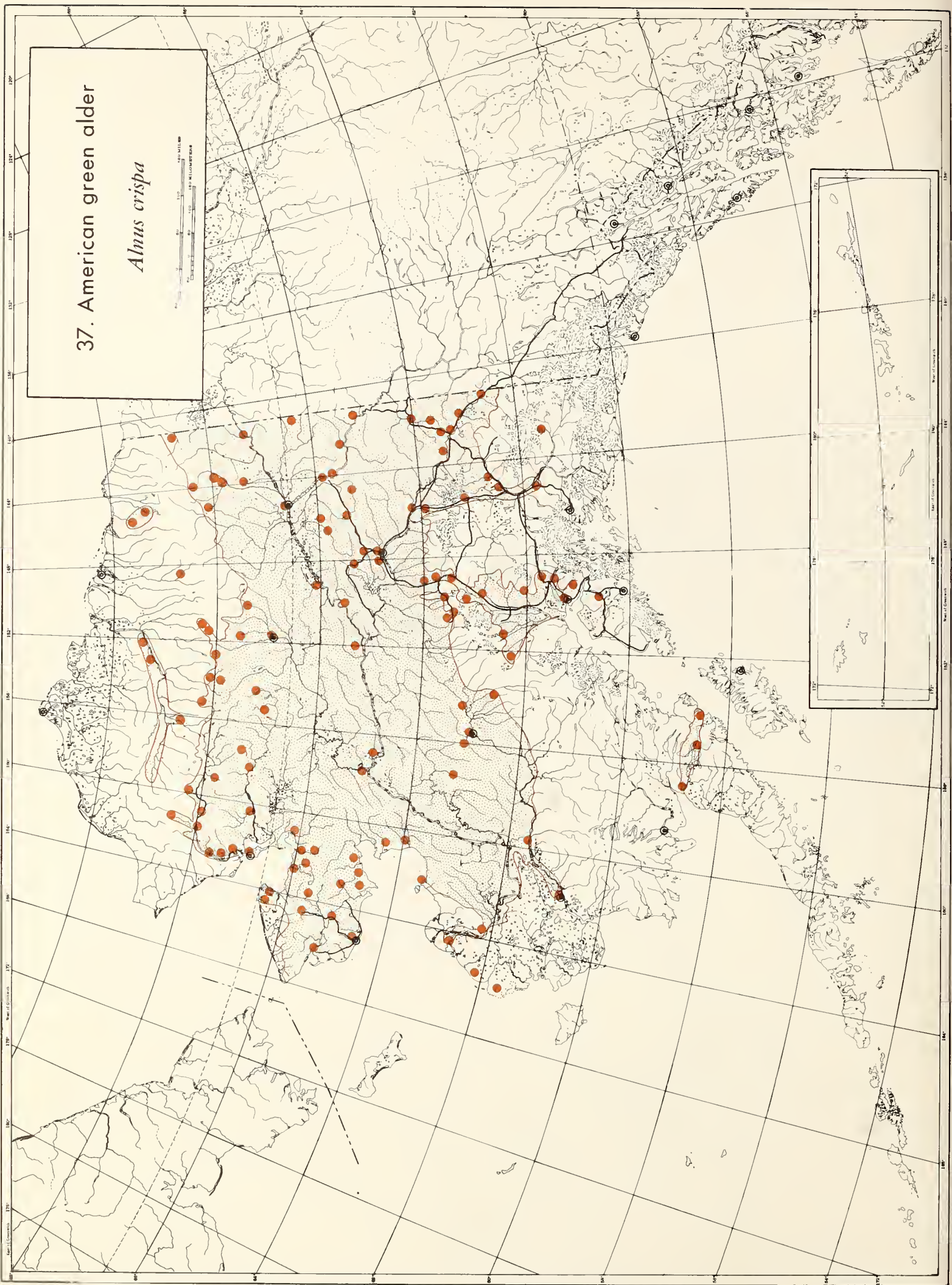
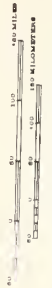


36. Paper birch

Betula papyrifera

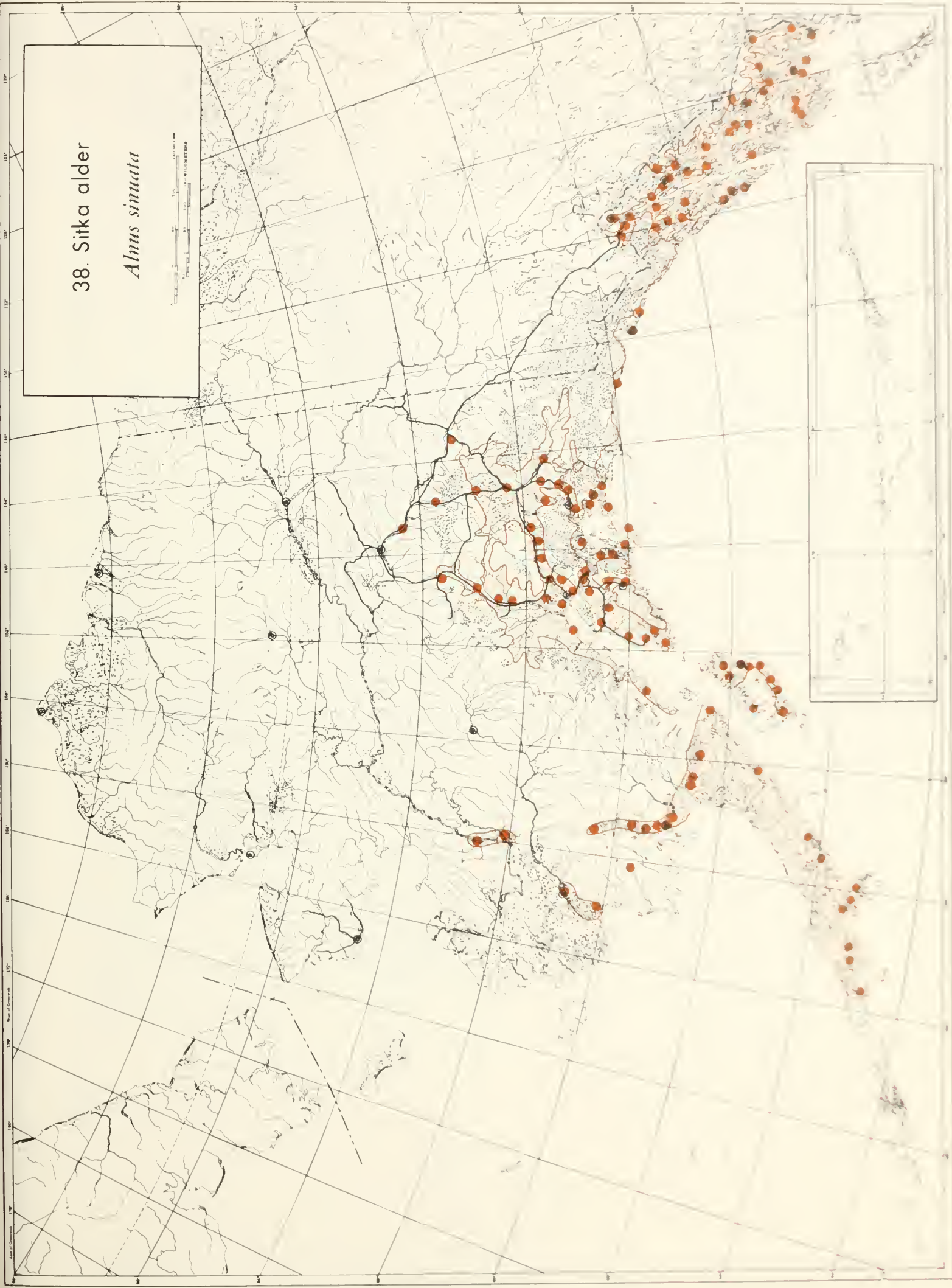


37. American green alder
Alnus crispa



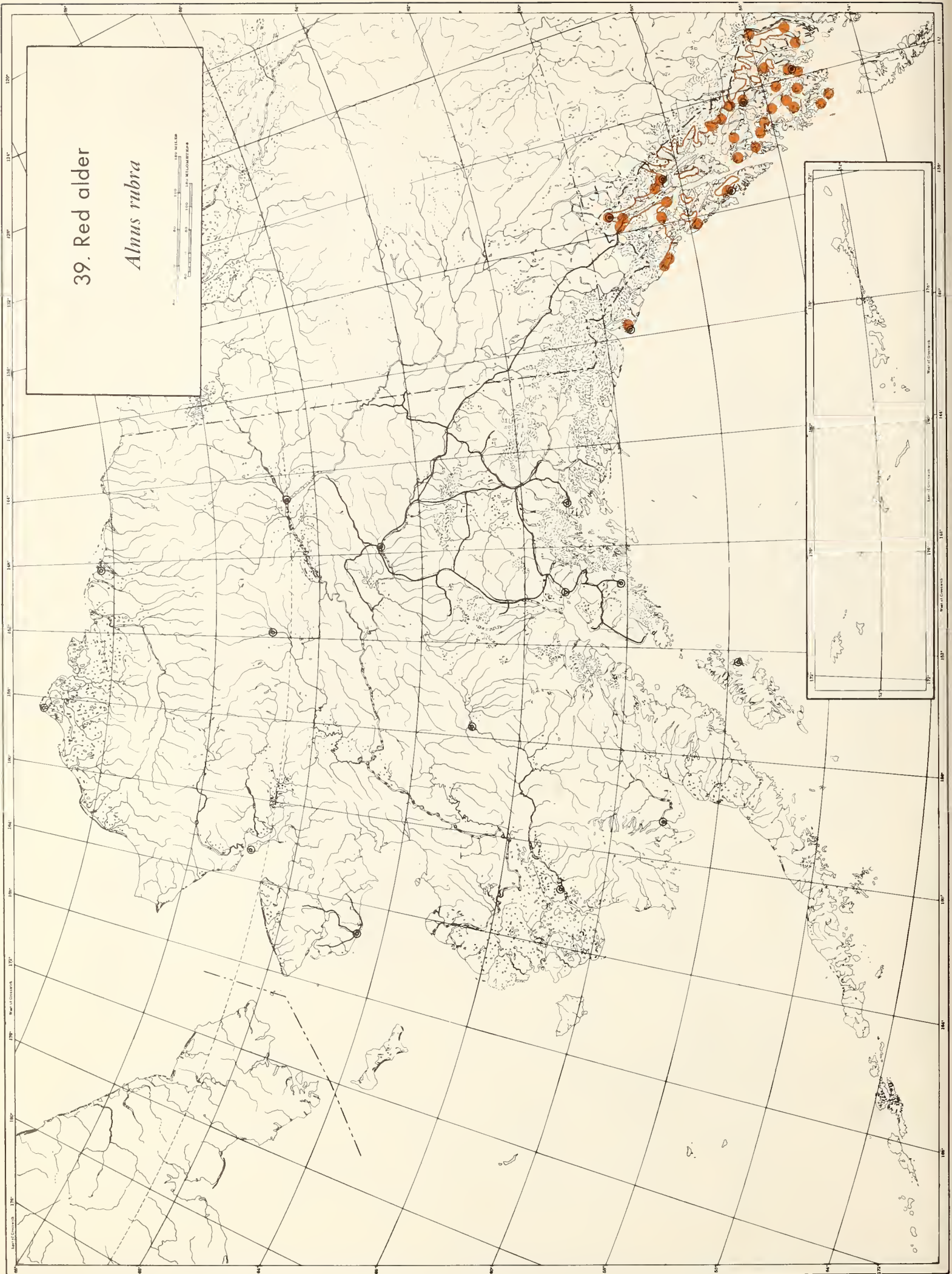
38. Sitka alder

Alnus sinuata



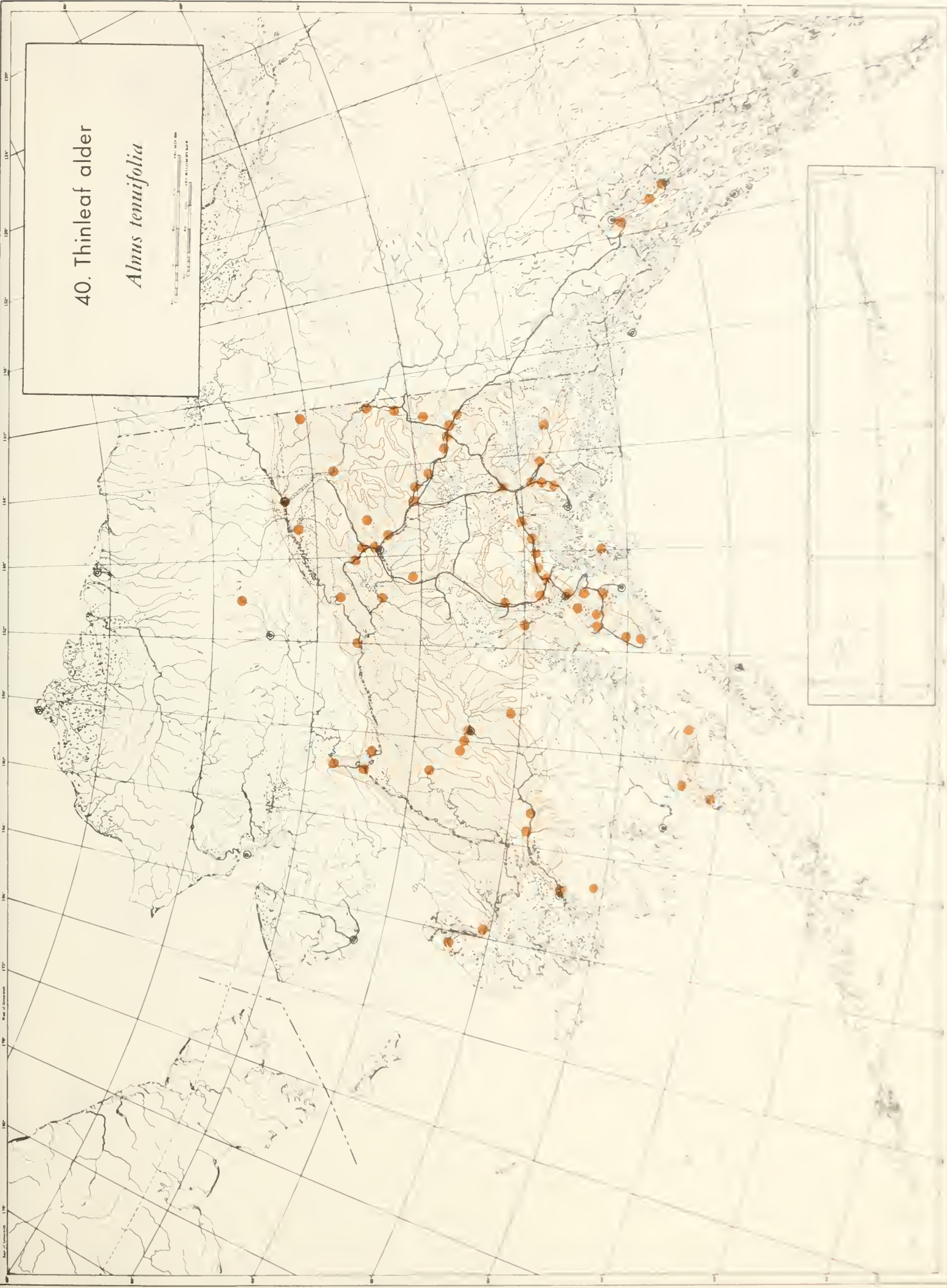
39. Red alder

Alnus rubra

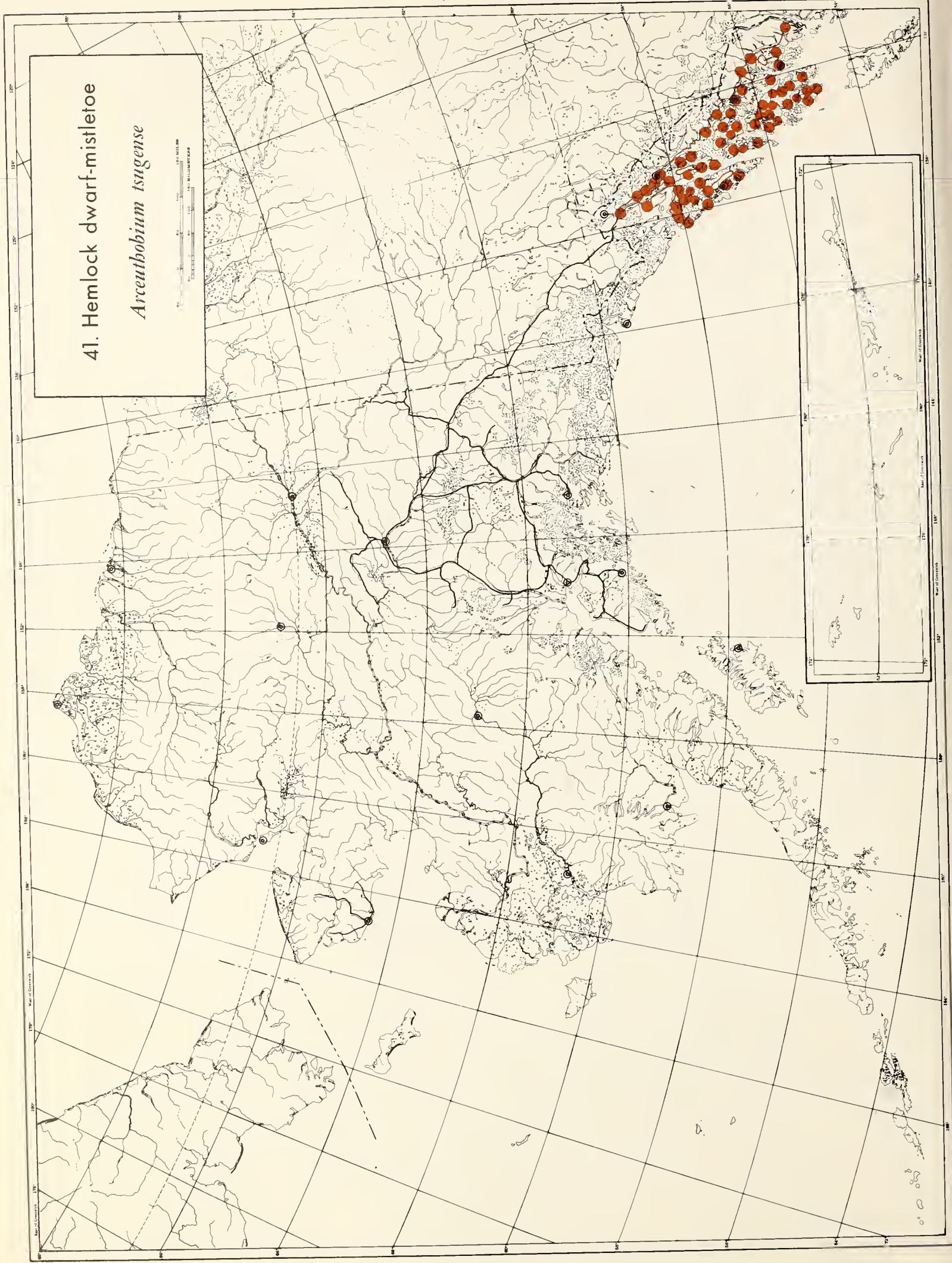


40. Thinleaf alder

Alnus tenuifolia

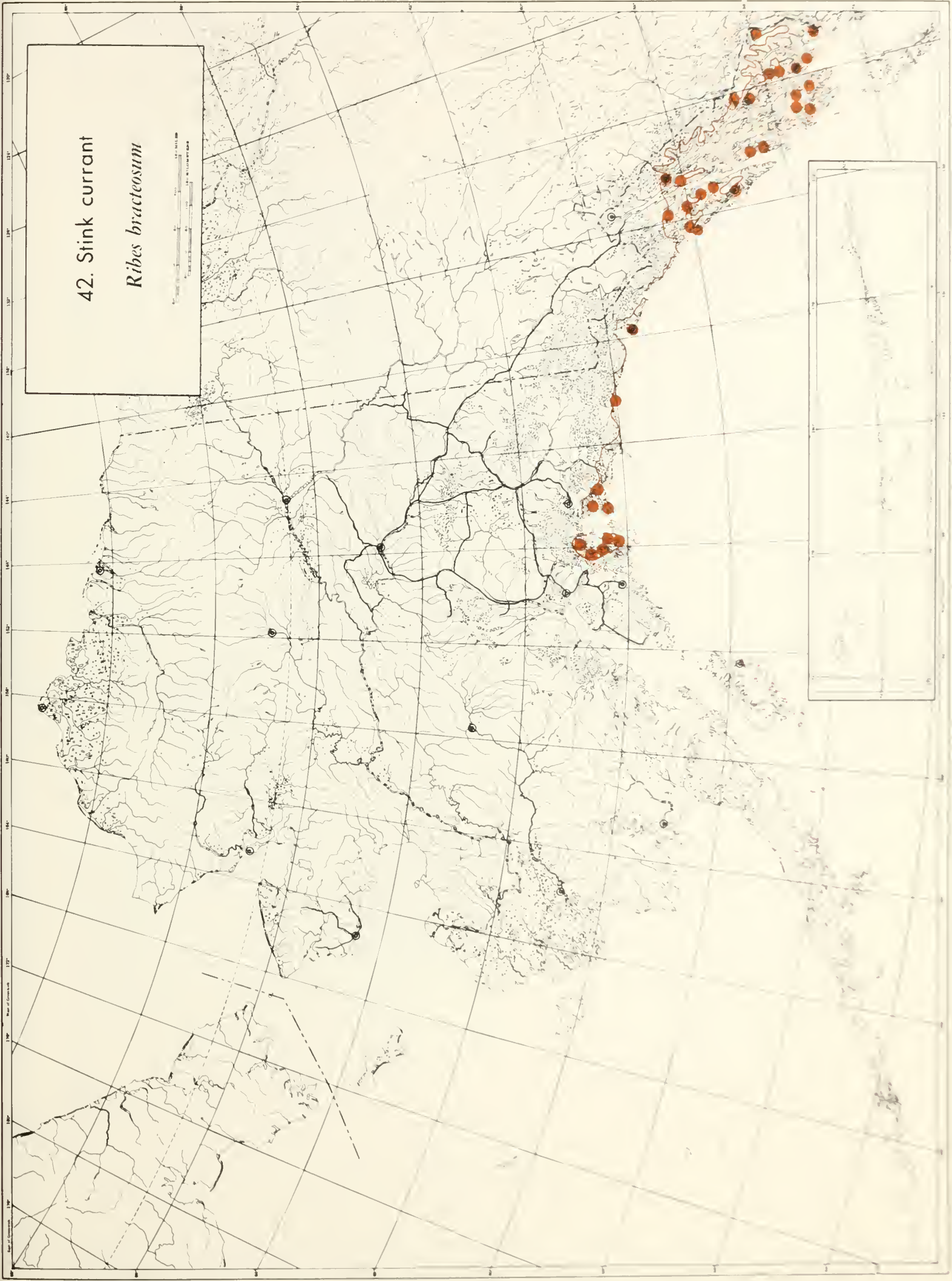
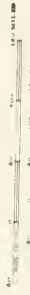


41. Hemlock dwarf-mistletoe
Arceuthobium tsugense



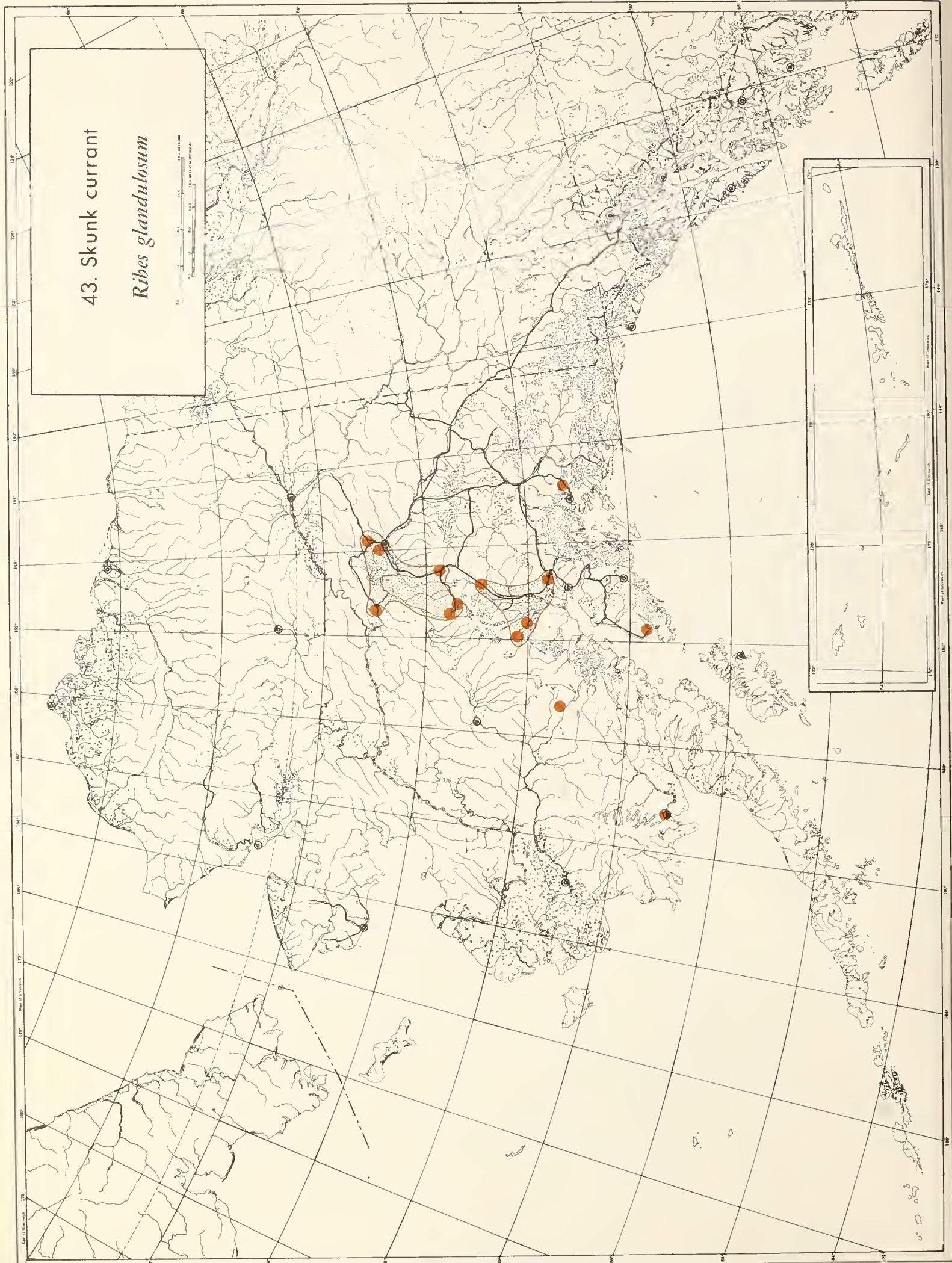
42. Stink currant

Ribes bracteosum



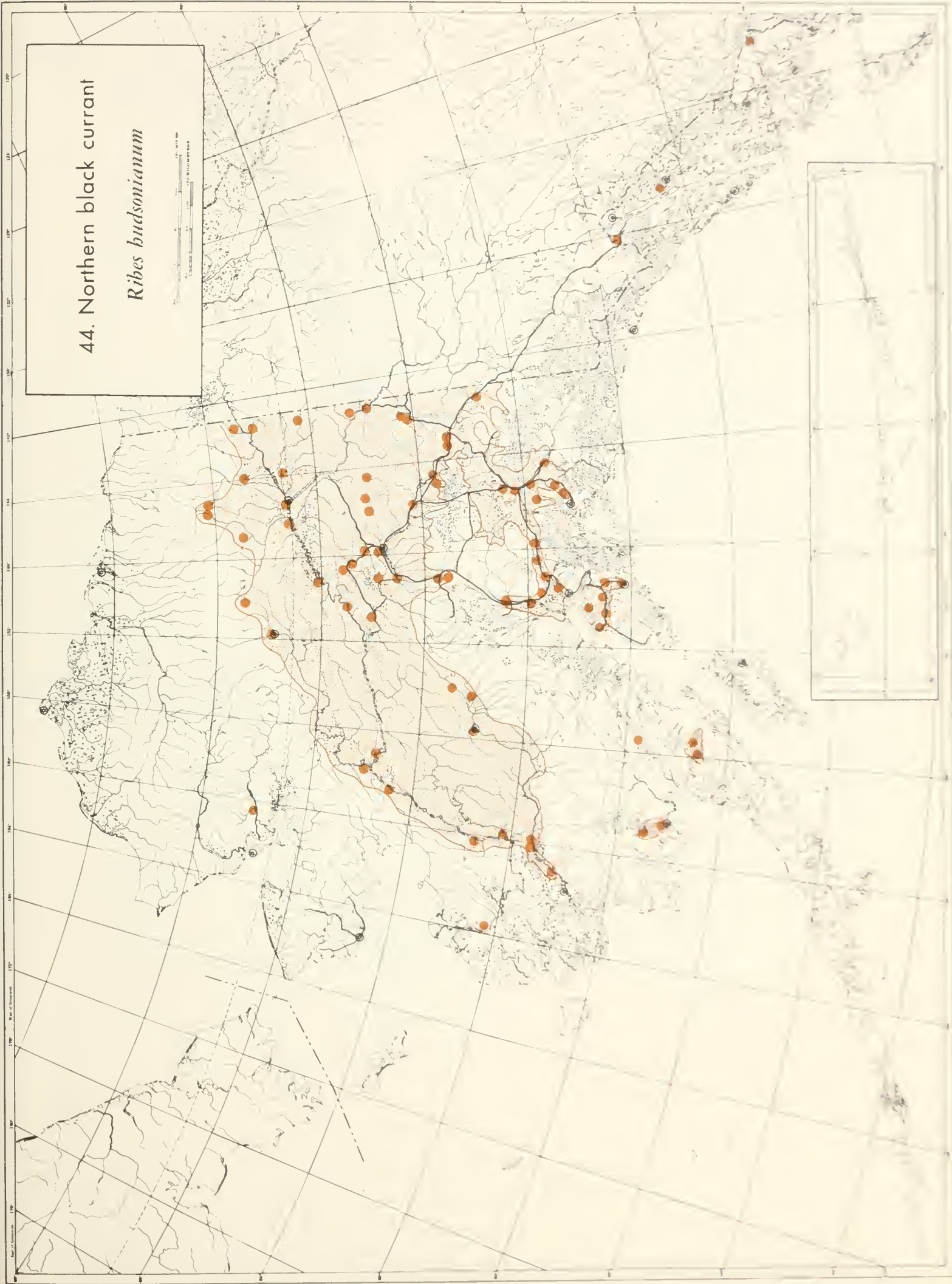
43. Skunk currant

Ribes glandulosum



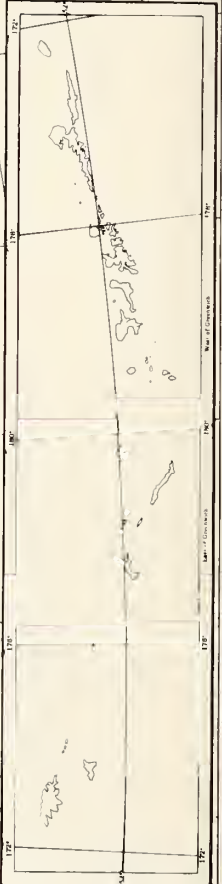
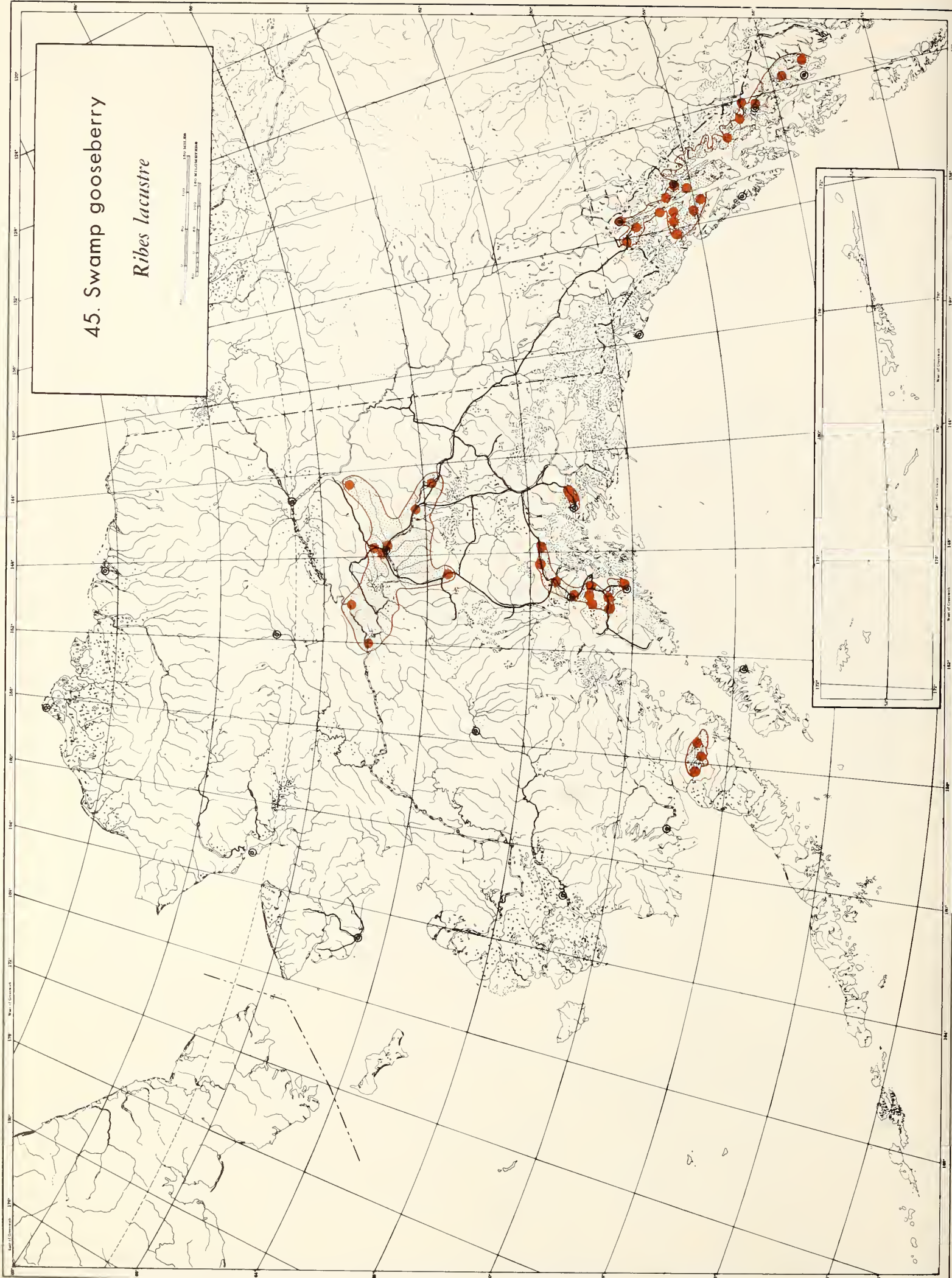
44. Northern black currant

Ribes budsonianum



45. Swamp gooseberry

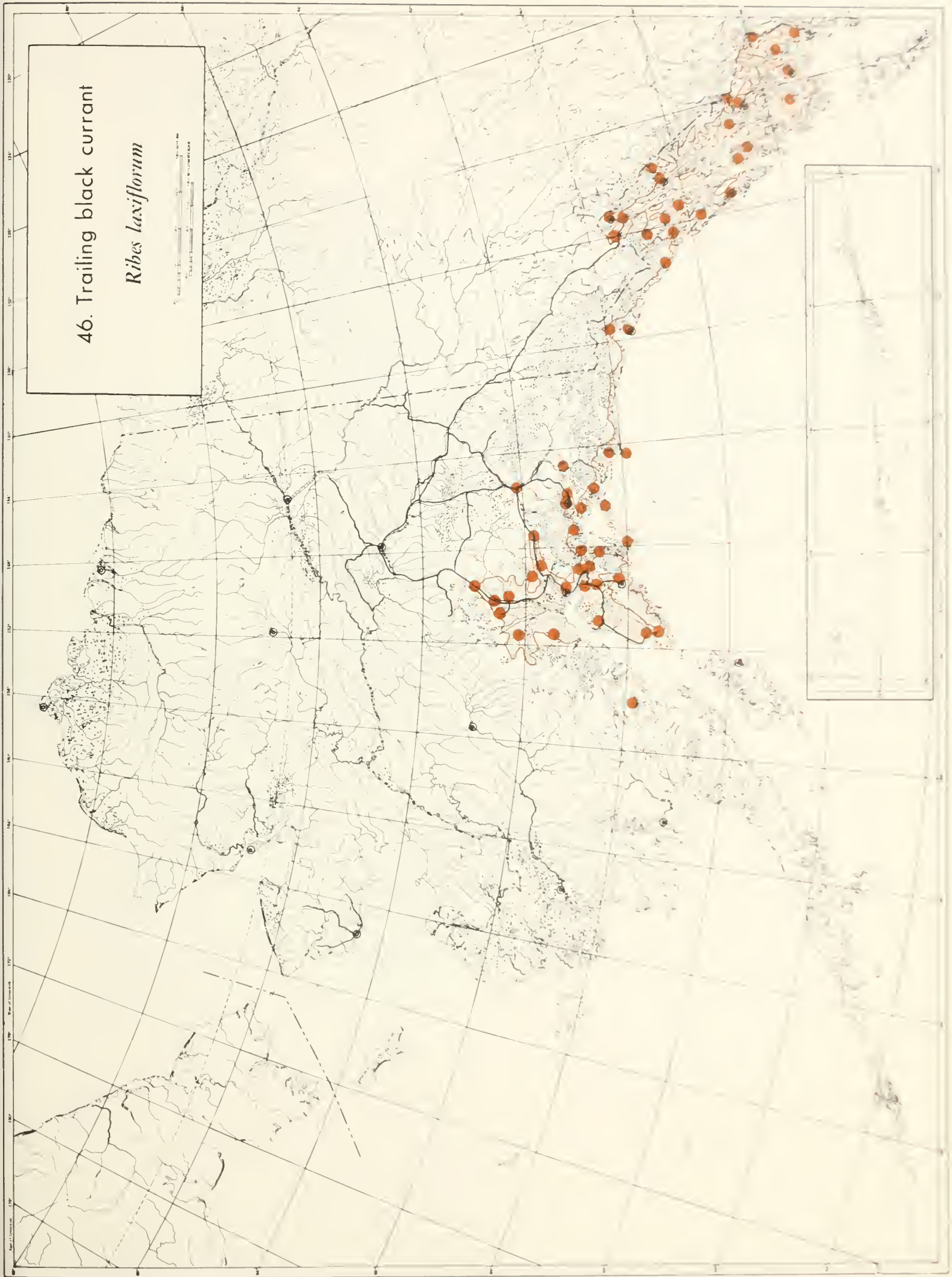
Ribes lacustre



46. Trailing black currant

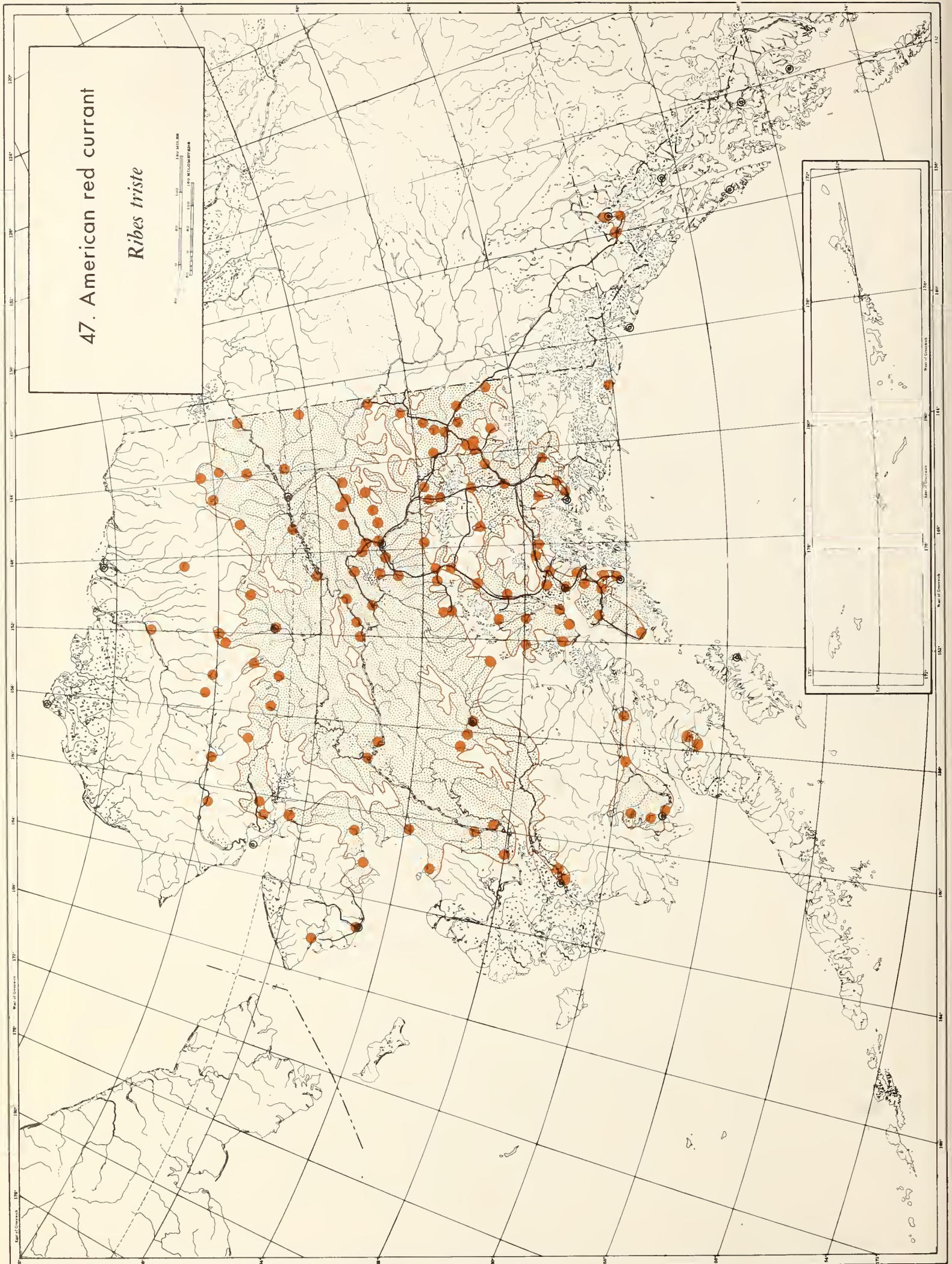
Ribes laxiflorum

Scale: 1:100,000
1:200,000
1:500,000
1:1,000,000



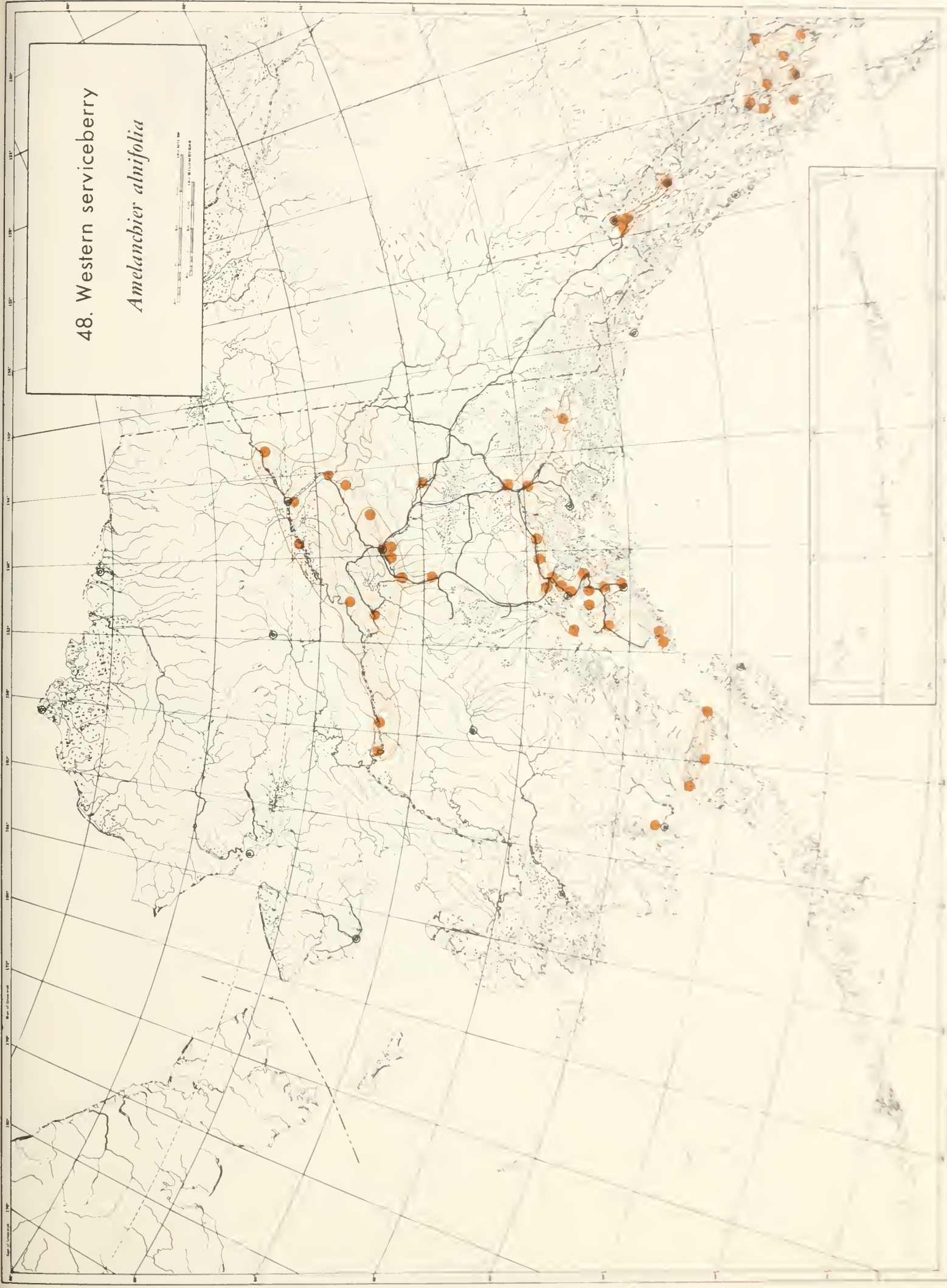
47. American red currant

Ribes triste



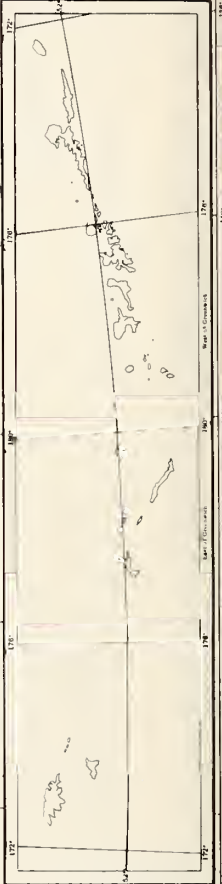
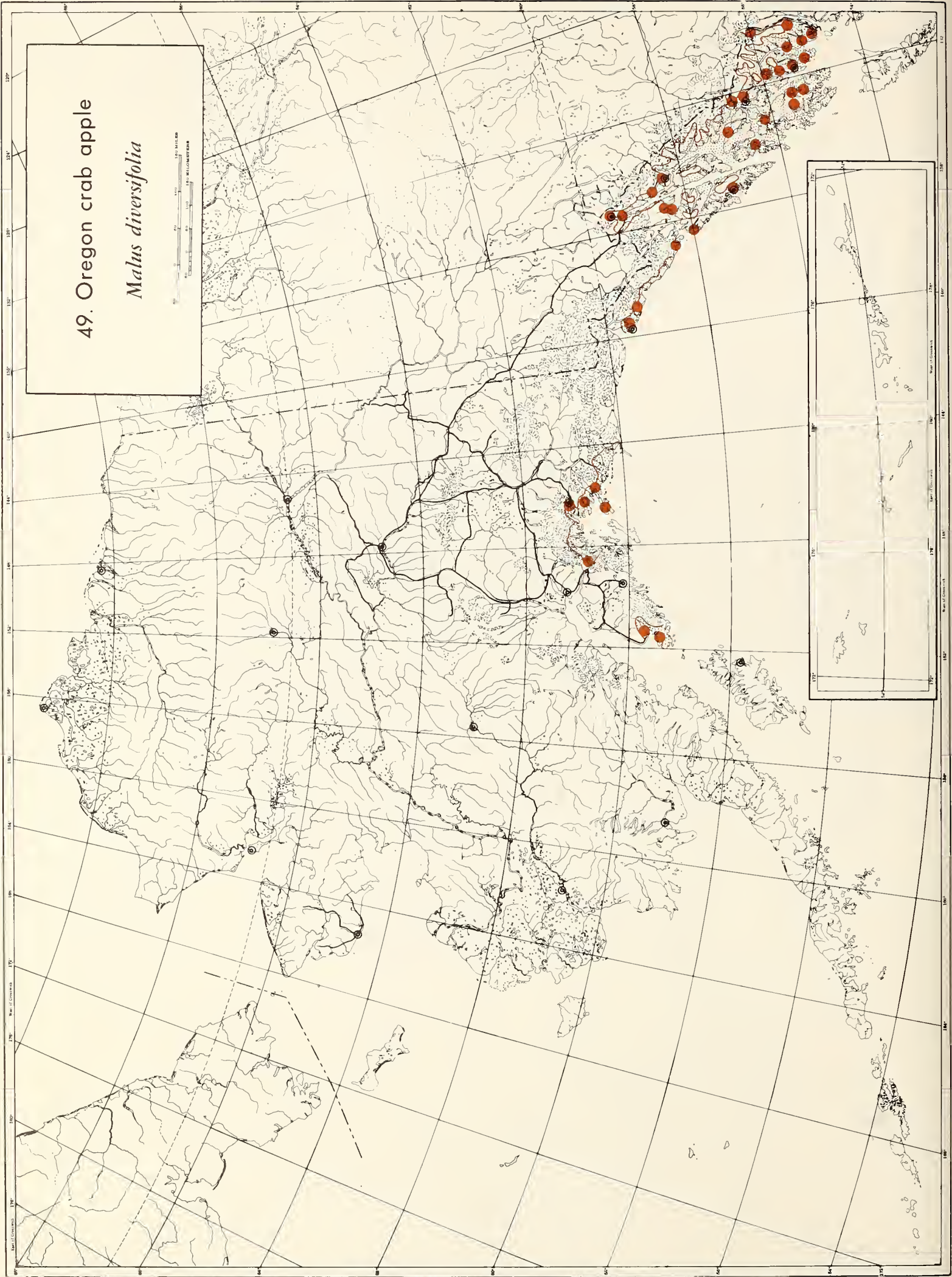
48. Western serviceberry

Amelanchier alnifolia



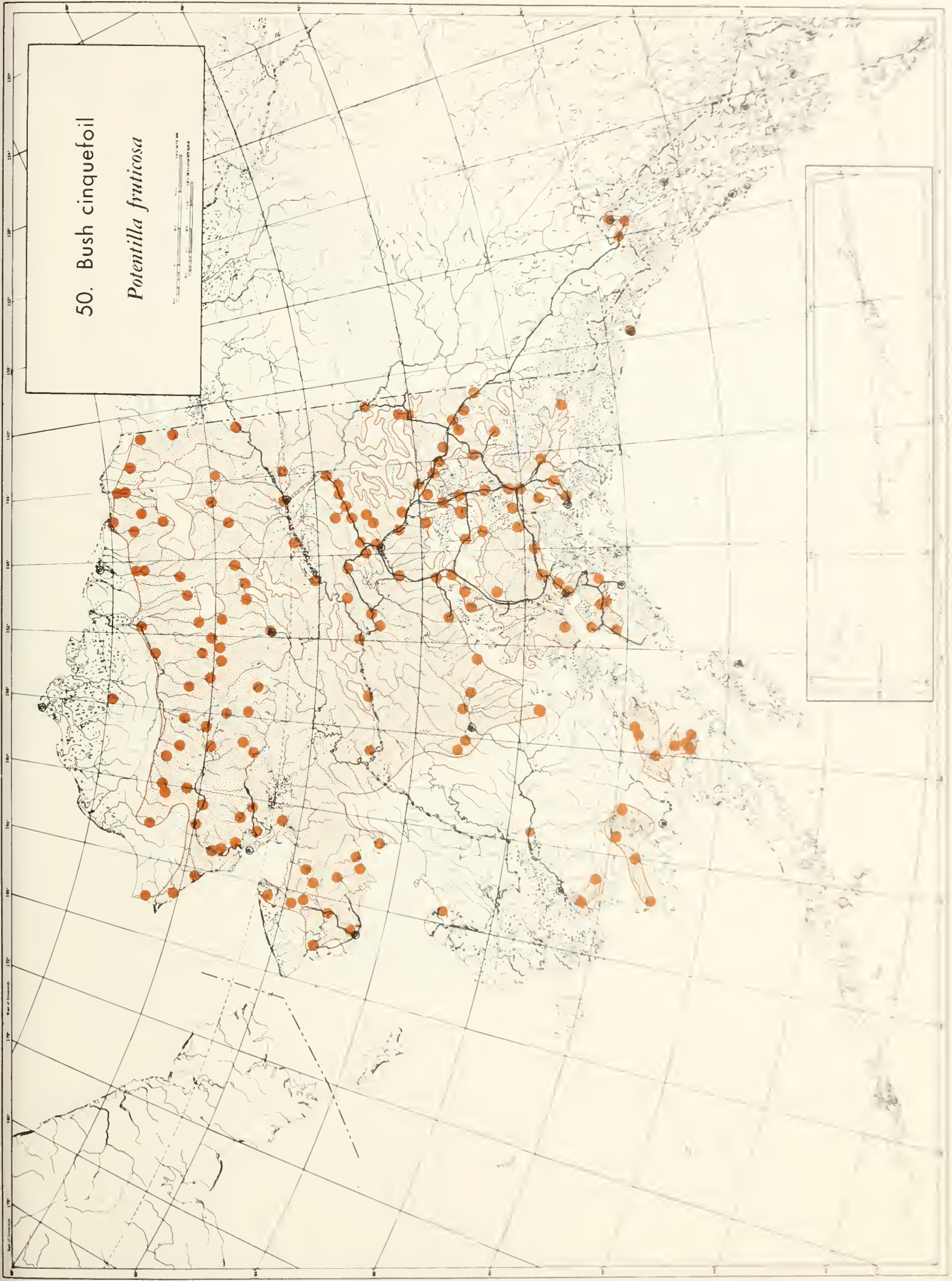
49. Oregon crab apple

Malus diversifolia



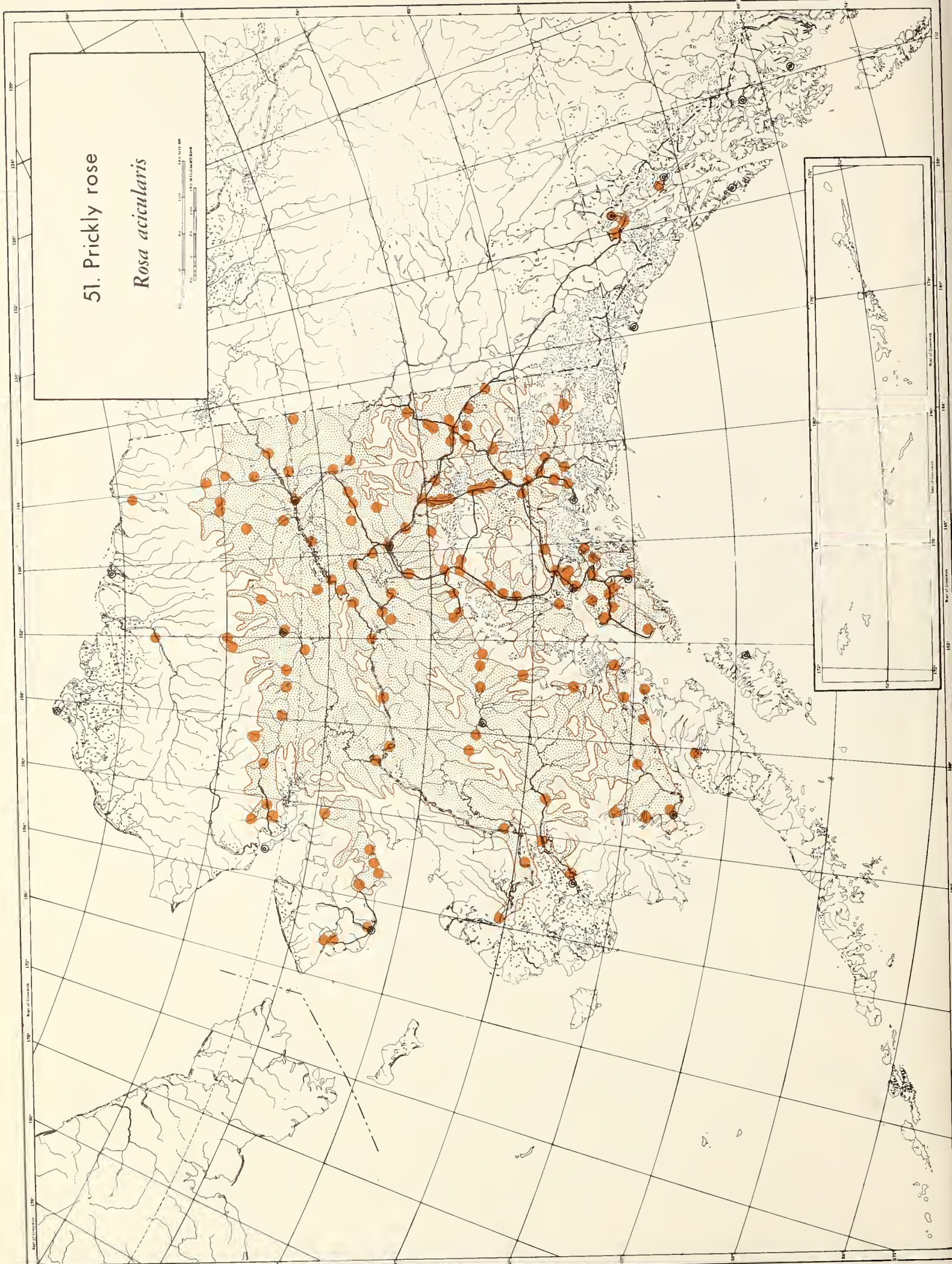
50. Bush cinquefoil

Potentilla fruticosa



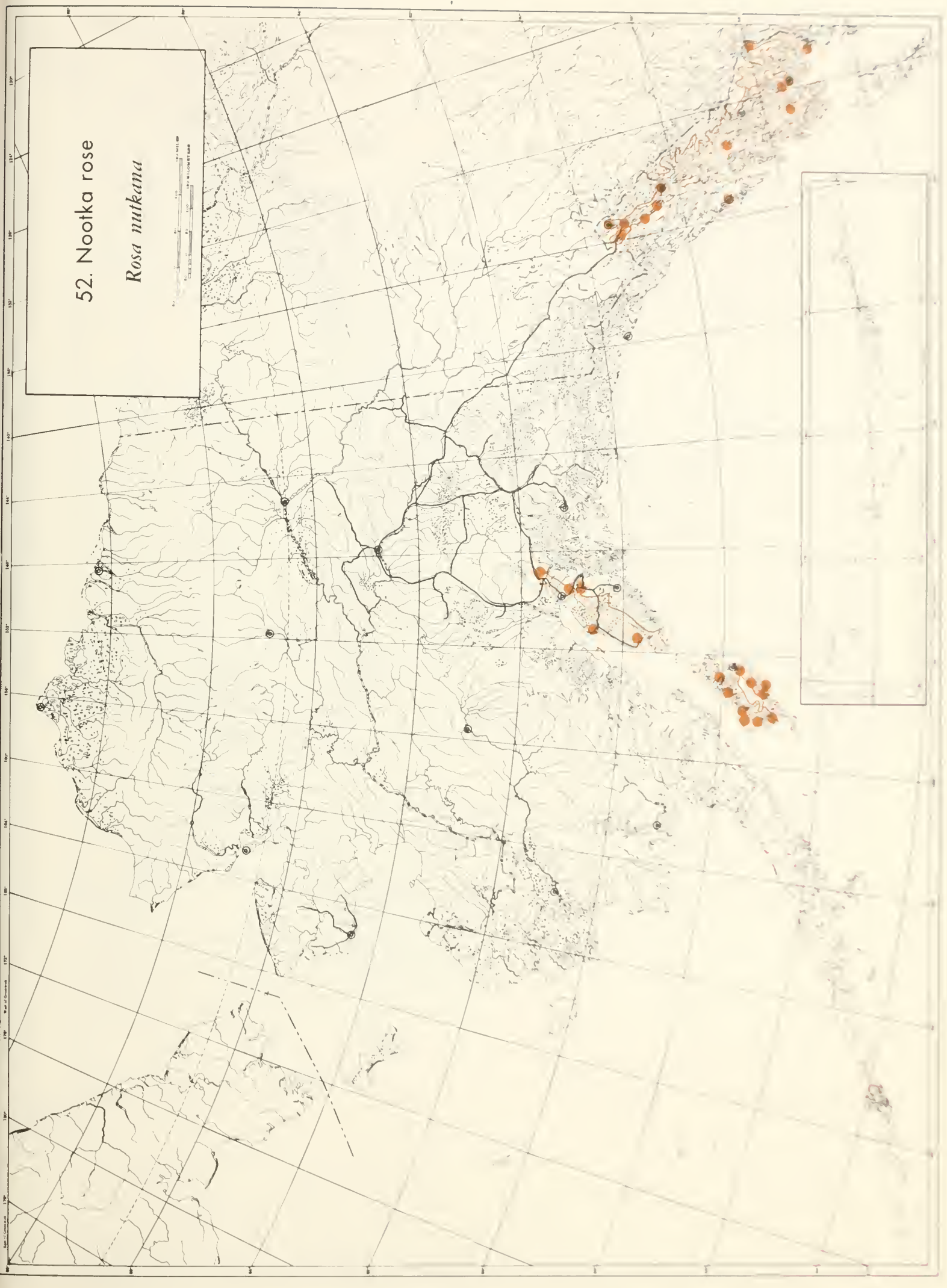
51. Prickly rose

Rosa acicularis



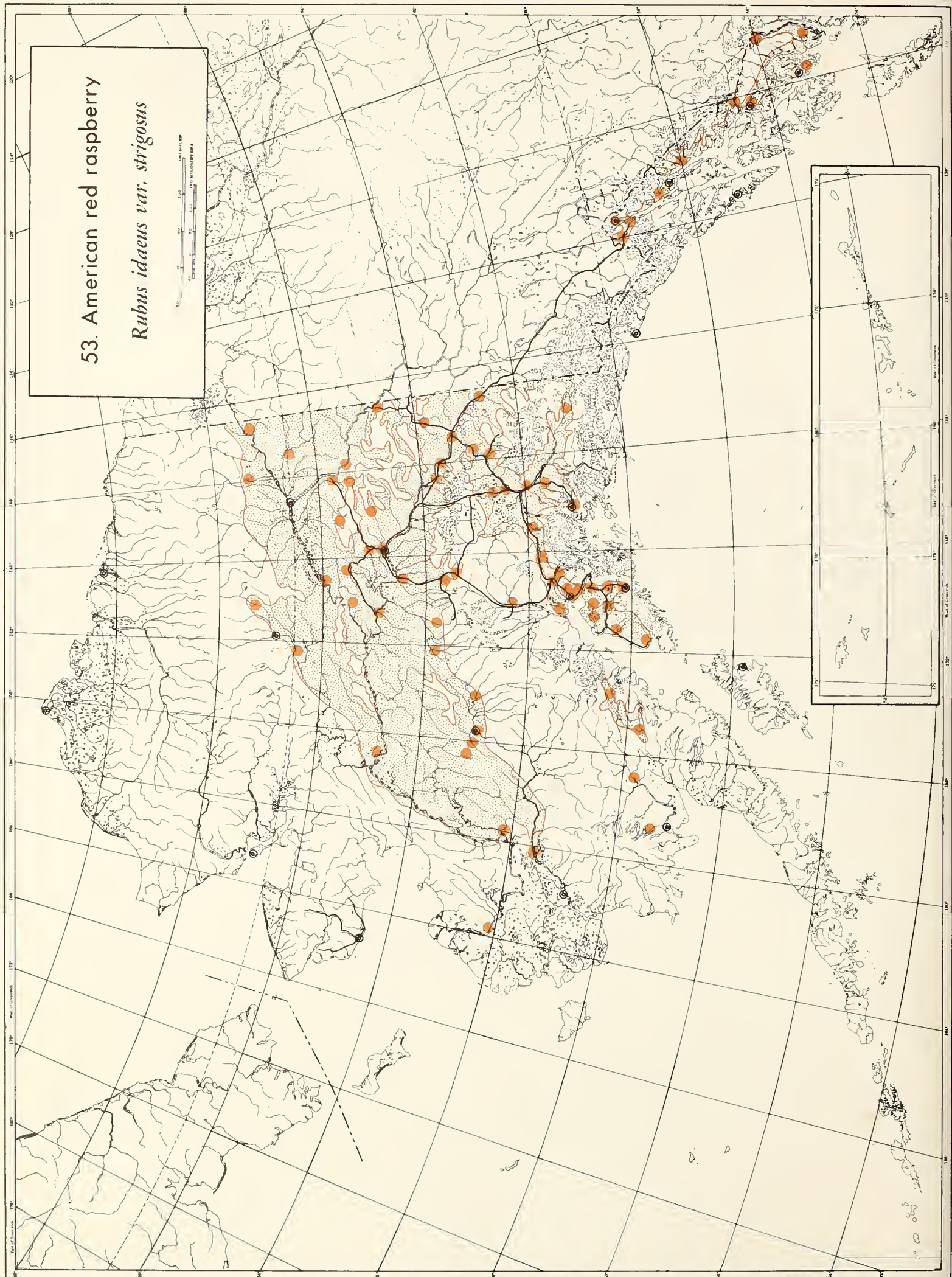
52. Nootka rose

Rosa nutkana



53. American red raspberry
Rubus idaeus var. *strigosus*

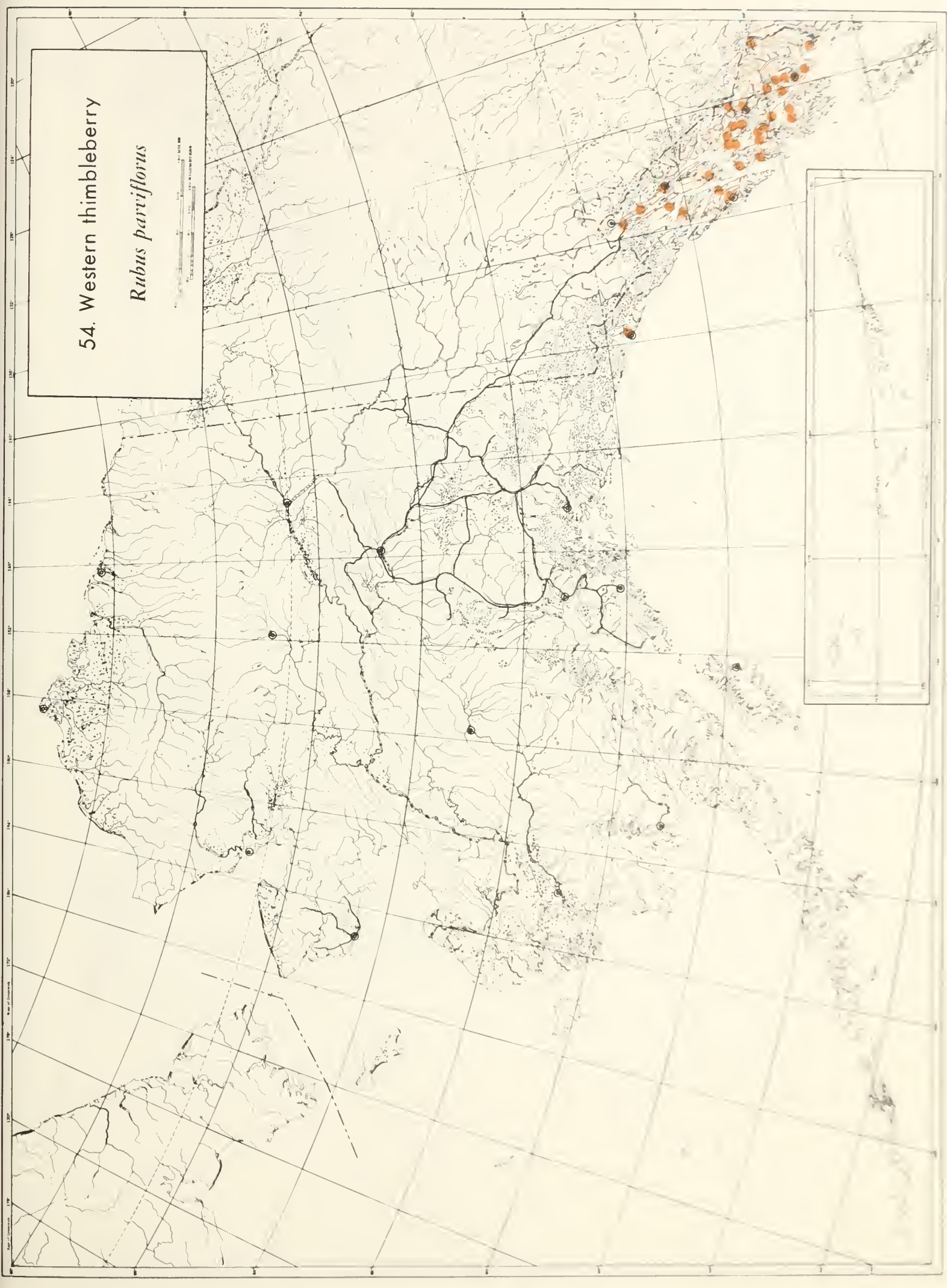
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520 530 540 550 560 570 580 590 600 610 620 630 640 650 660 670 680 690 700 710 720 730 740 750 760 770 780 790 800 810 820 830 840 850 860 870 880 890 900 910 920 930 940 950 960 970 980 990 1000



54. Western thimbleberry

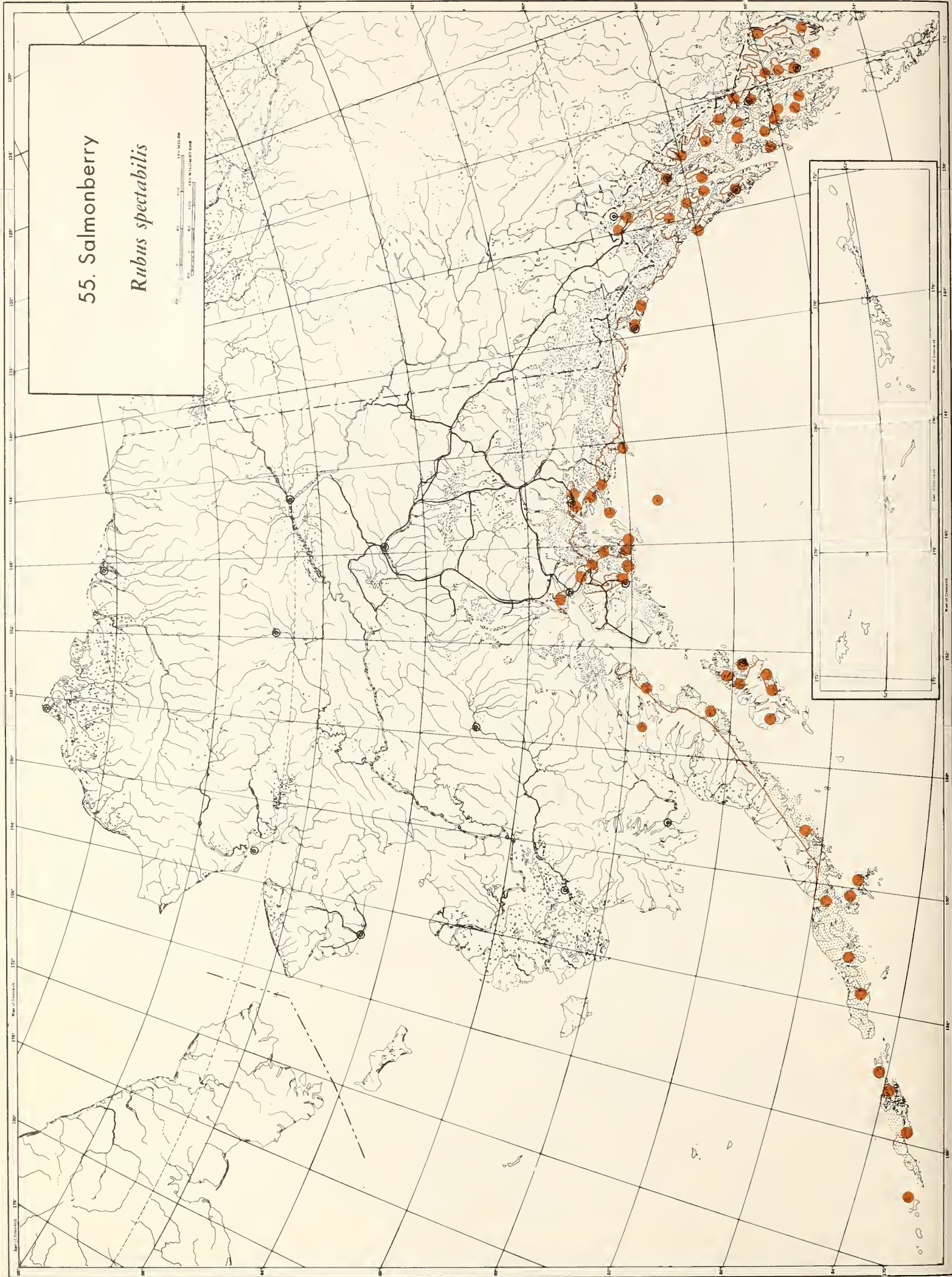
Rubus parviflorus

Scale: 1:100,000
1:50,000
1:25,000
1:12,500
1:6,250
1:3,125



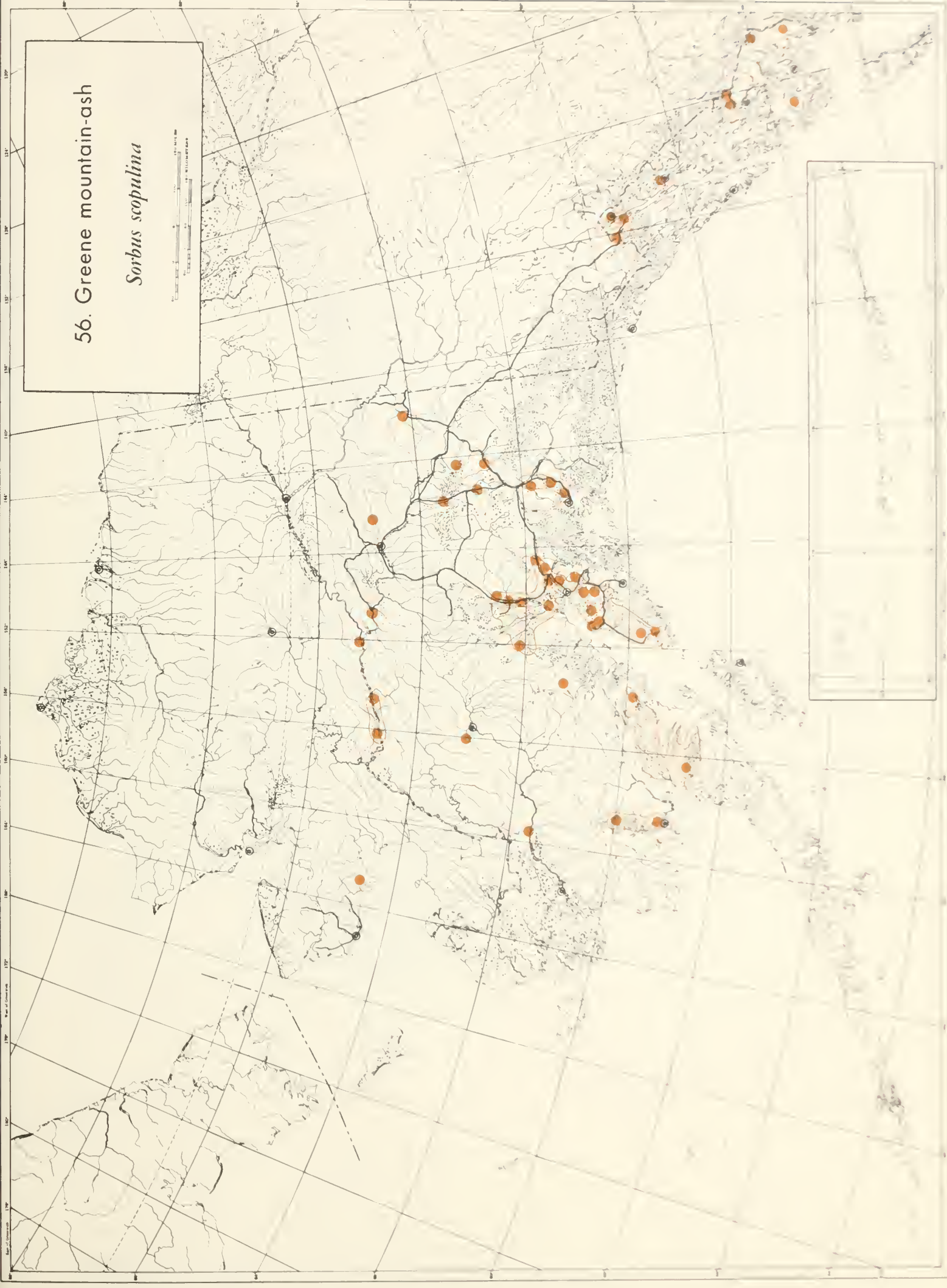
55. Salmonberry

Rubus spectabilis



56. Greene mountain-ash

Sorbus scopulina



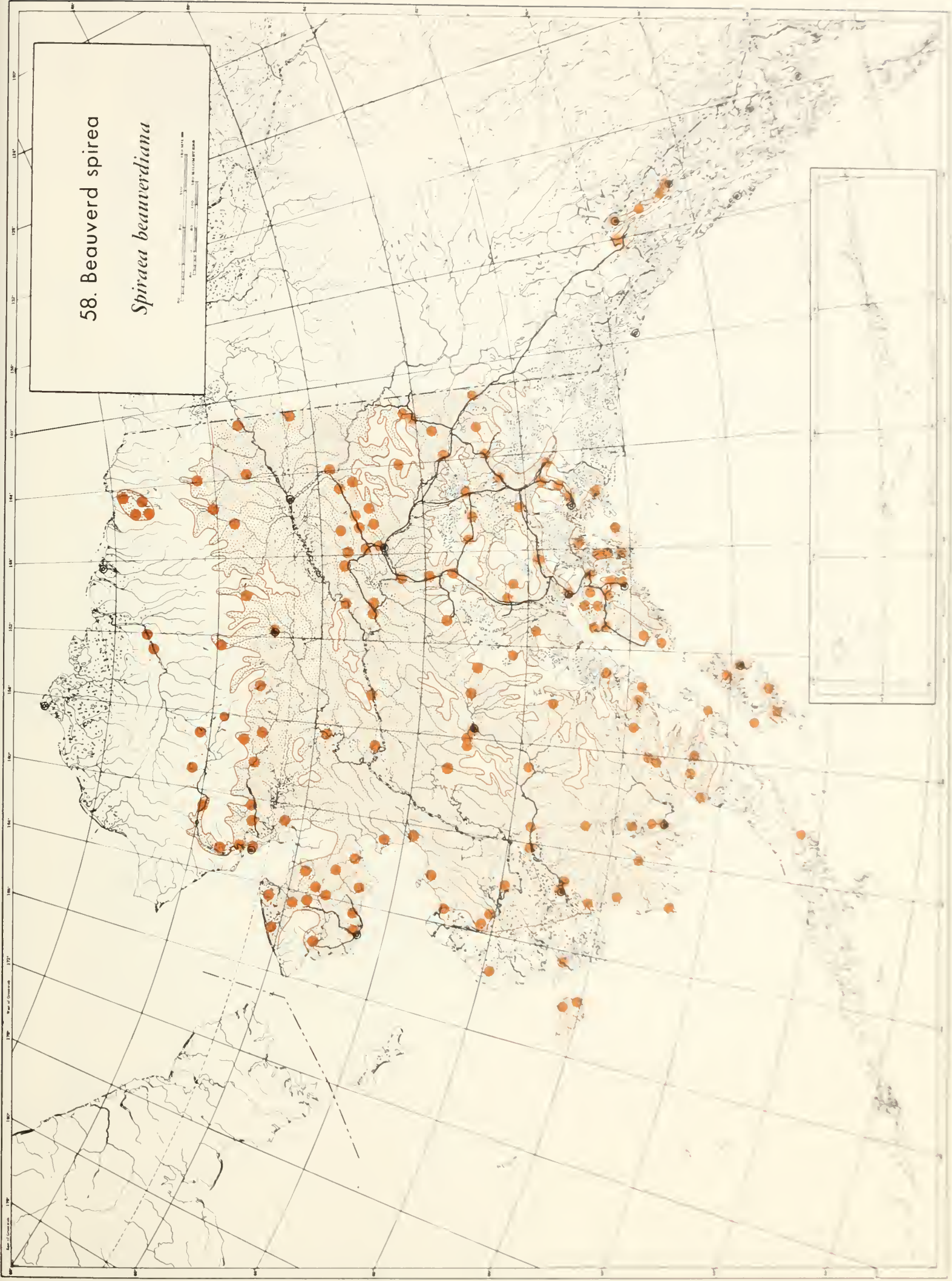
57. Sitka mountain-ash

Sorbus sitchensis

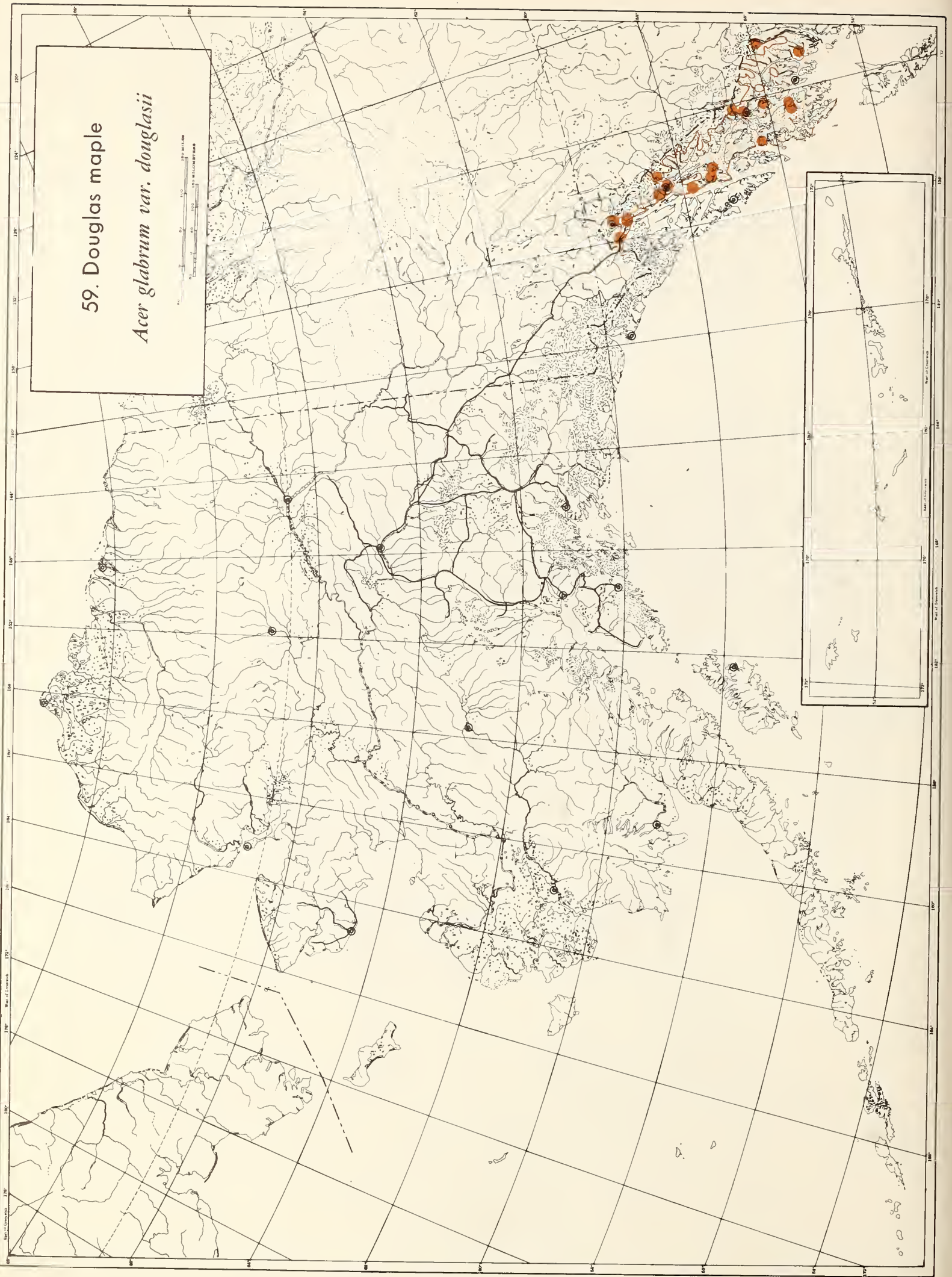
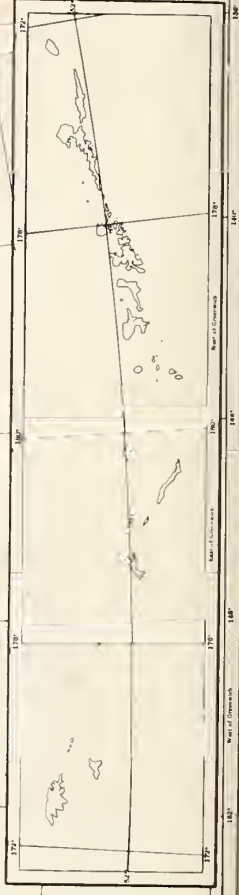


58. Beauverd spirea

Spiraea beauverdiana

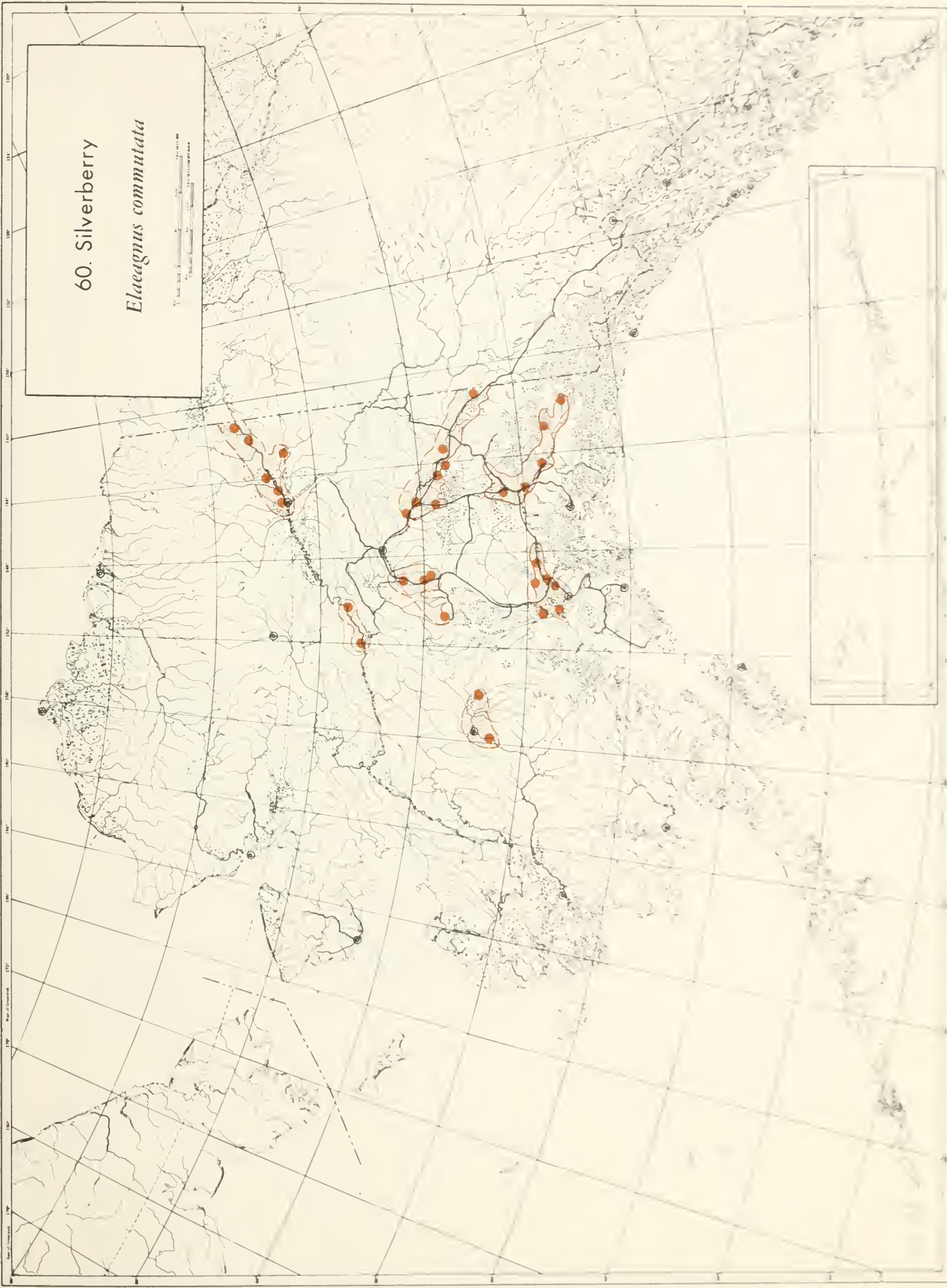


59. Douglas maple
Acer glabrum var. *douglasii*

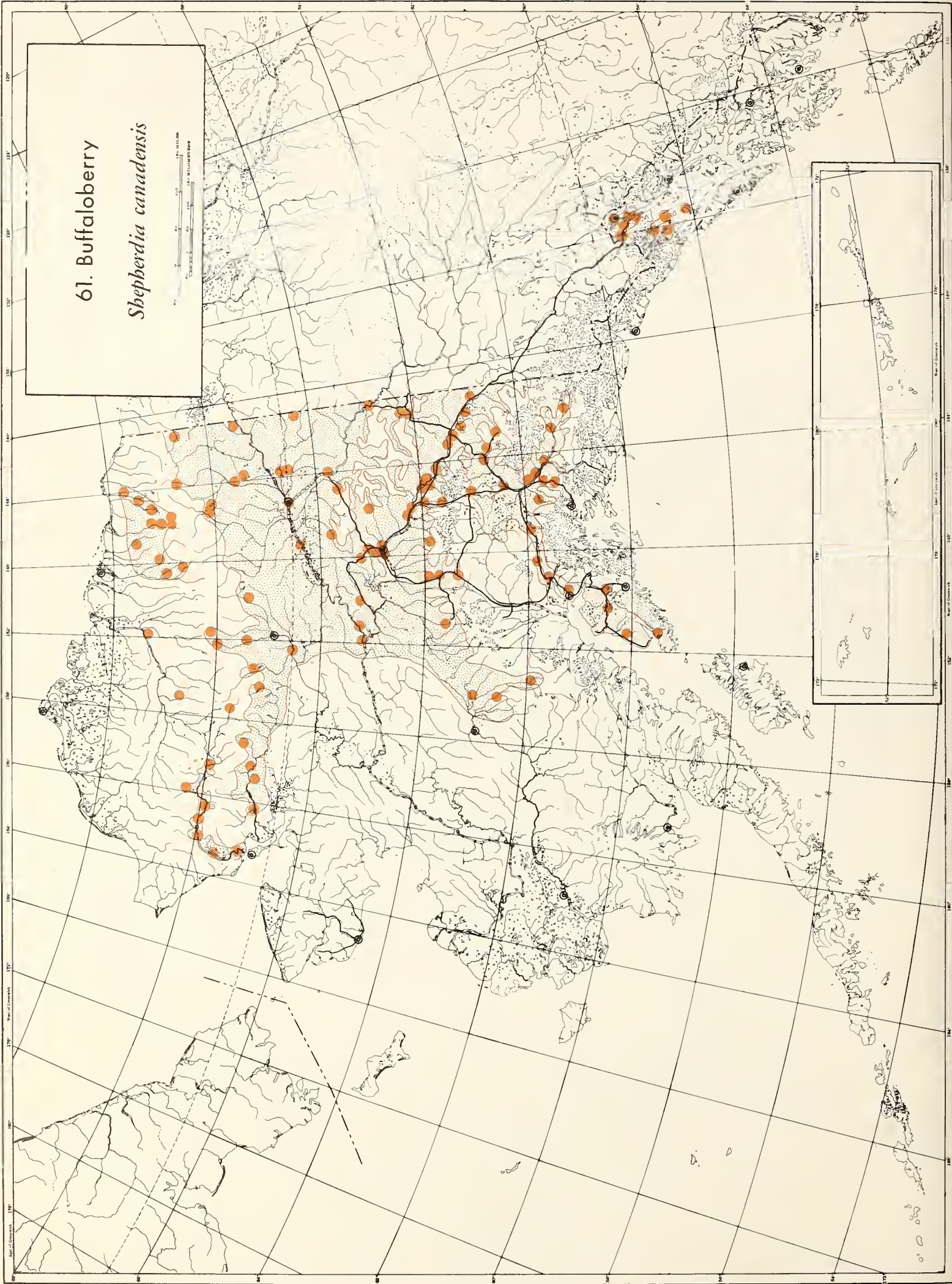
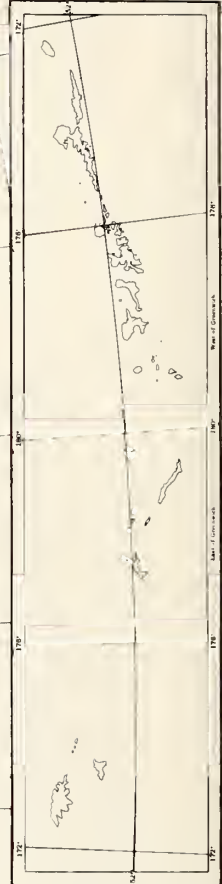


60. Silverberry

Elaeagnus commutata

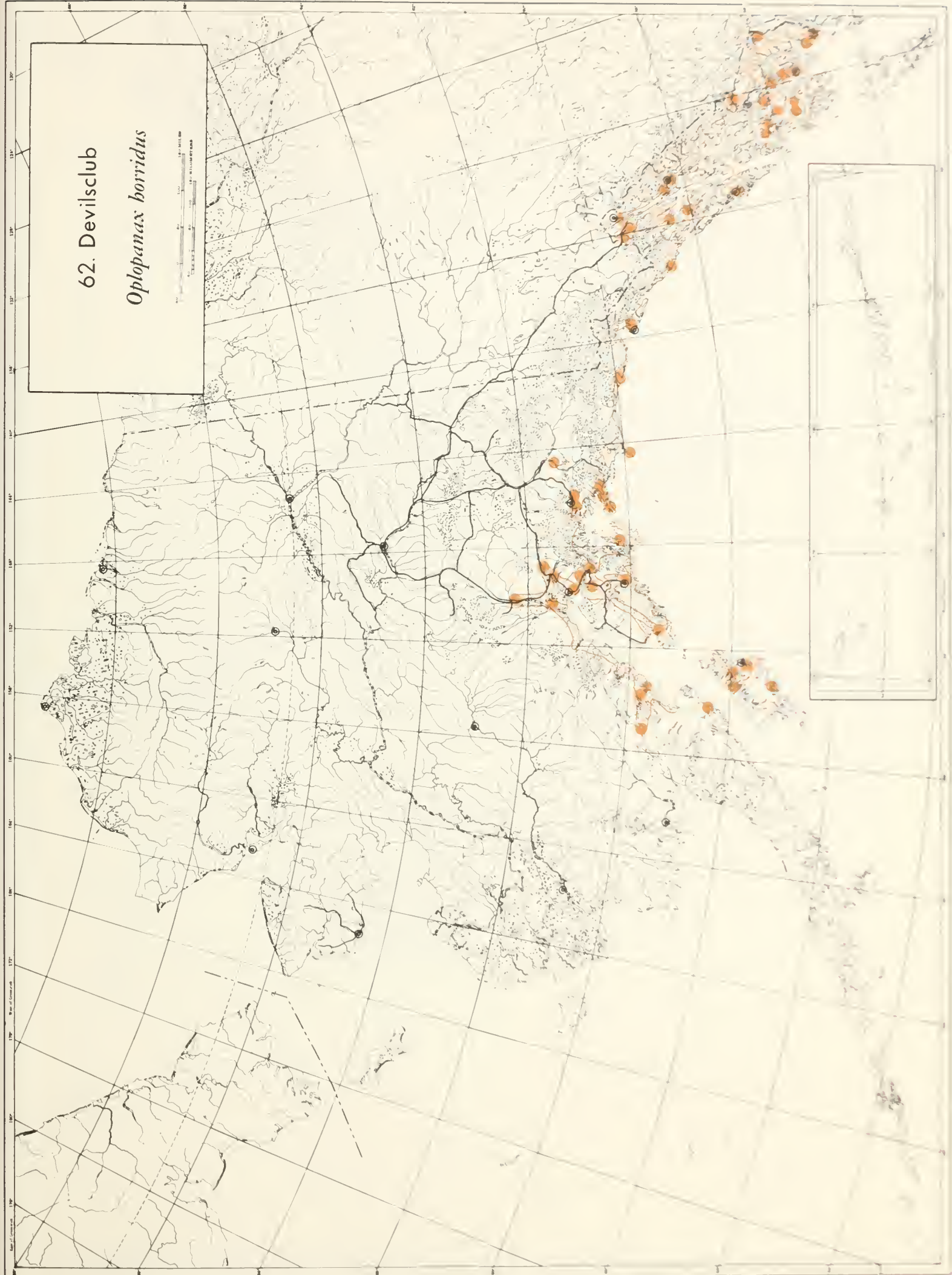


61. Buffaloberry
Shepherdia canadensis



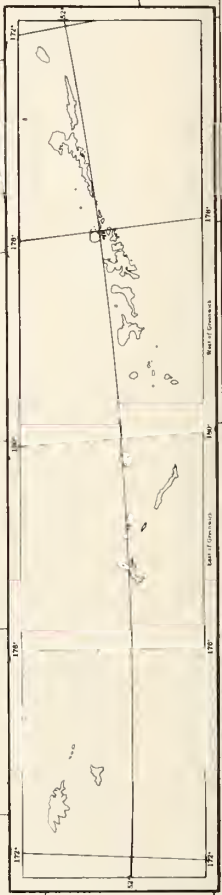
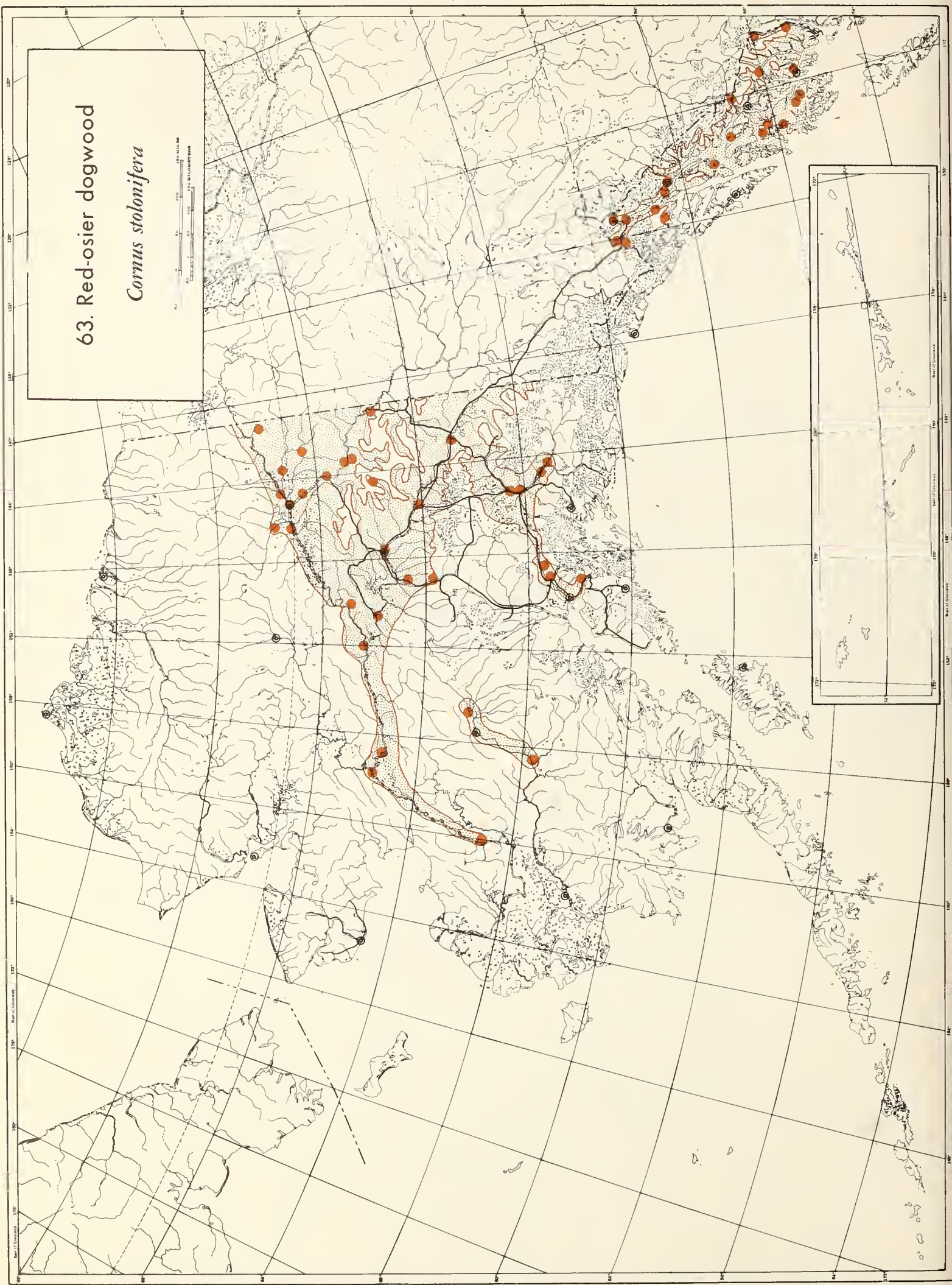
62. Devilsclub

Oplopanax borridus



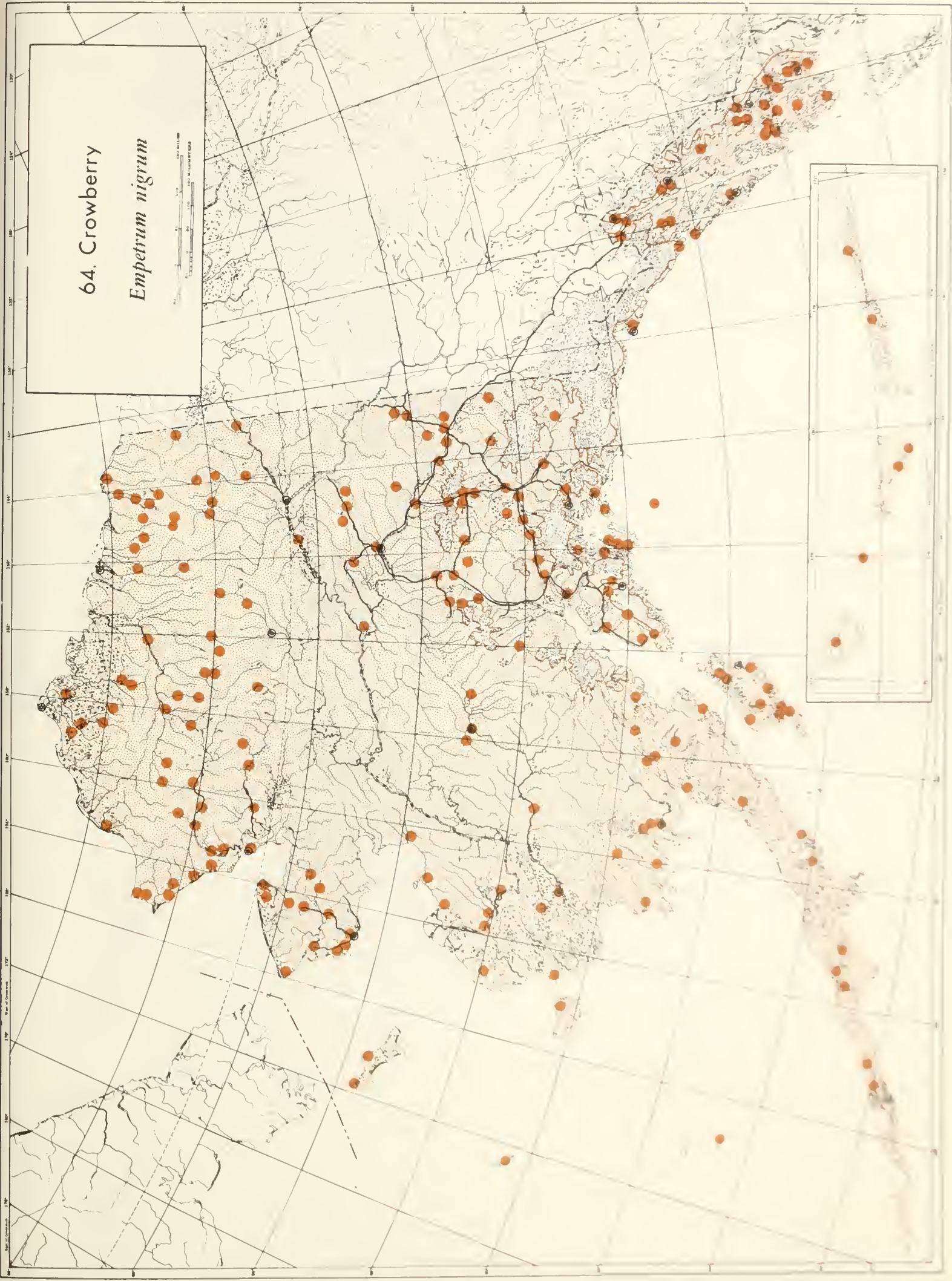
63. Red-osier dogwood

Cornus stolonifera



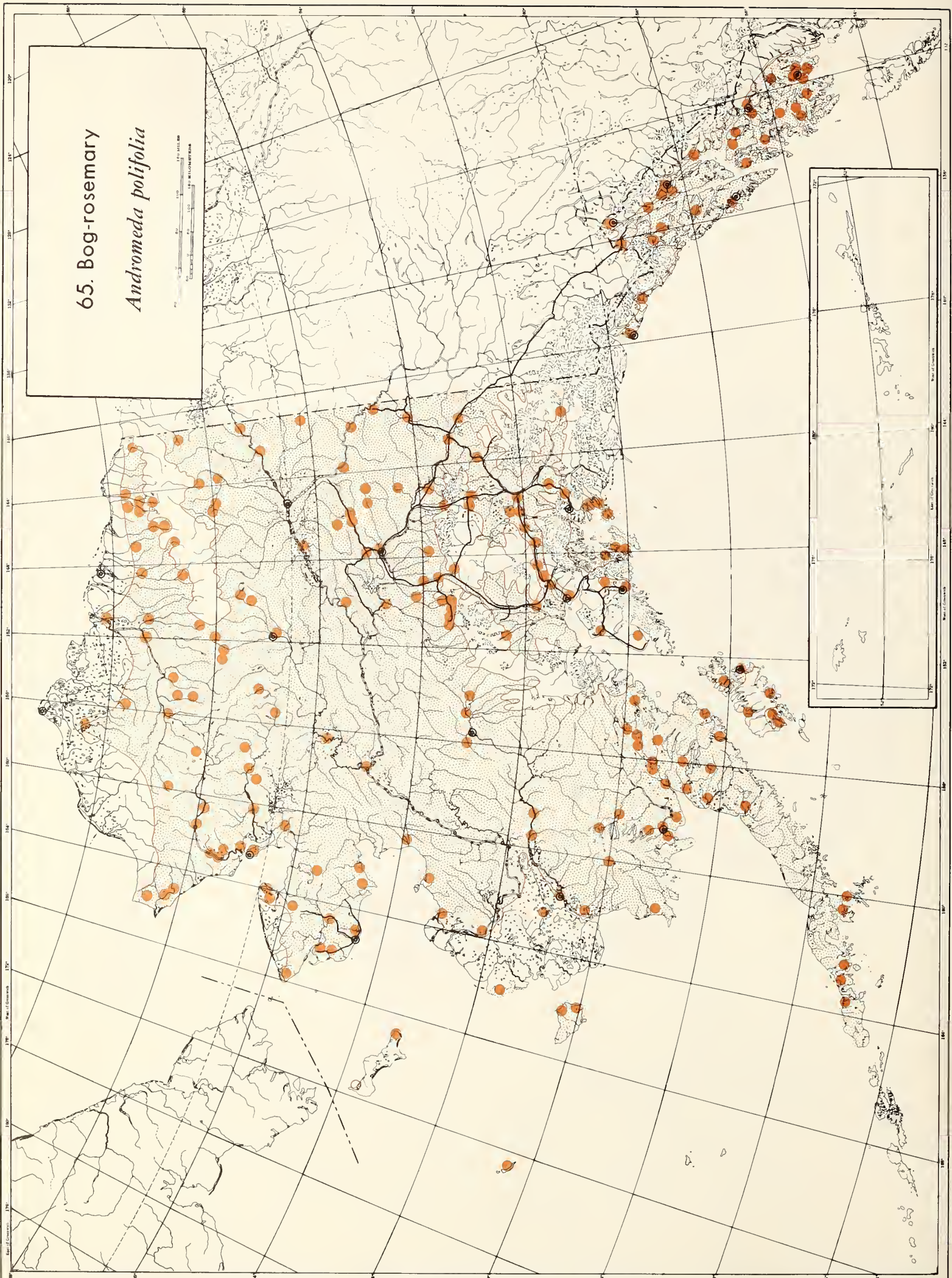
64. Crowberry

Empetrum nigrum



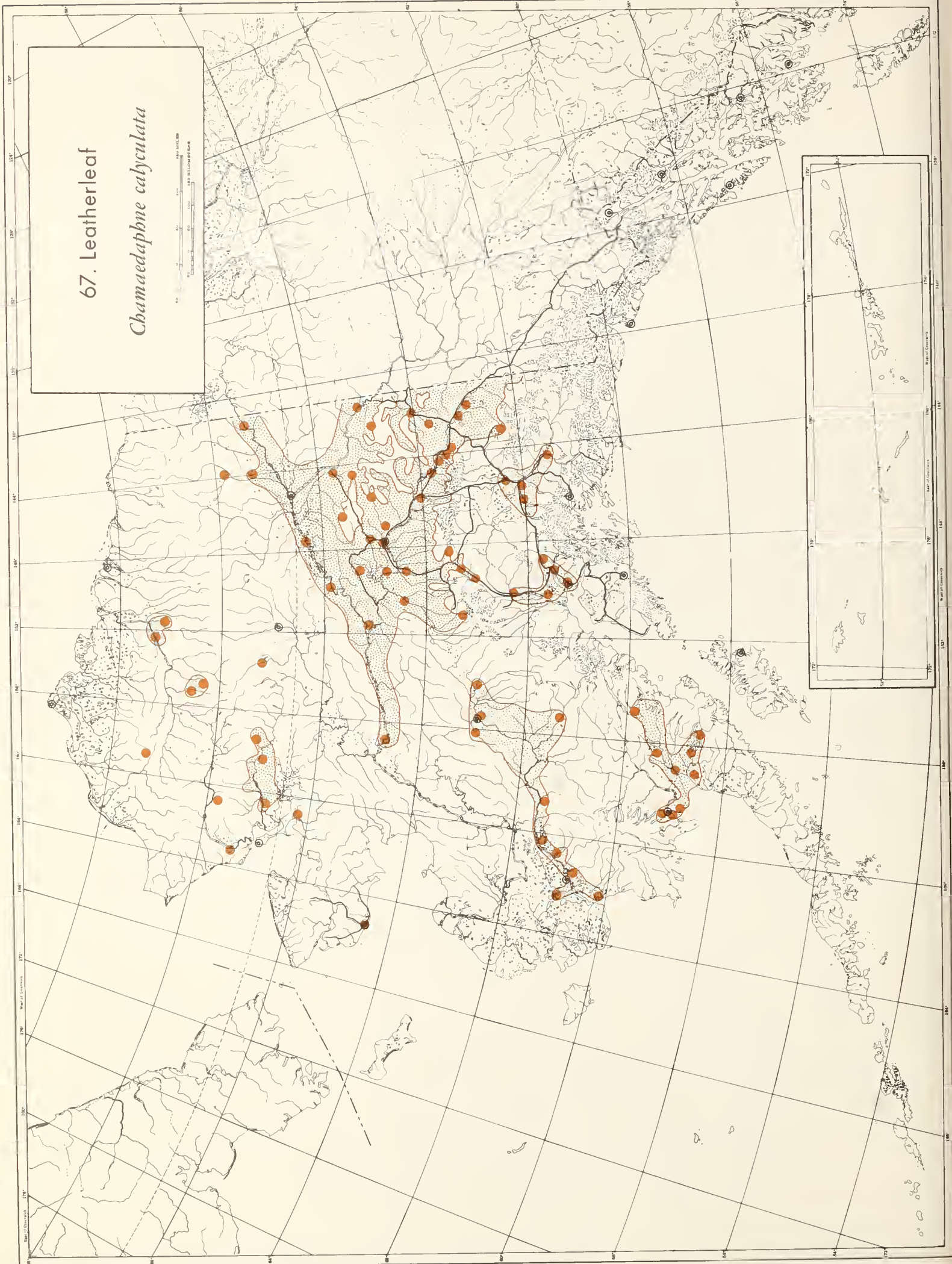
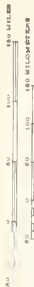
65. Bog-rosemary
Andromeda polifolia

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520 530 540 550 560 570 580 590 600 610 620 630 640 650 660 670 680 690 700 710 720 730 740 750 760 770 780 790 800 810 820 830 840 850 860 870 880 890 900 910 920 930 940 950 960 970 980 990 1000



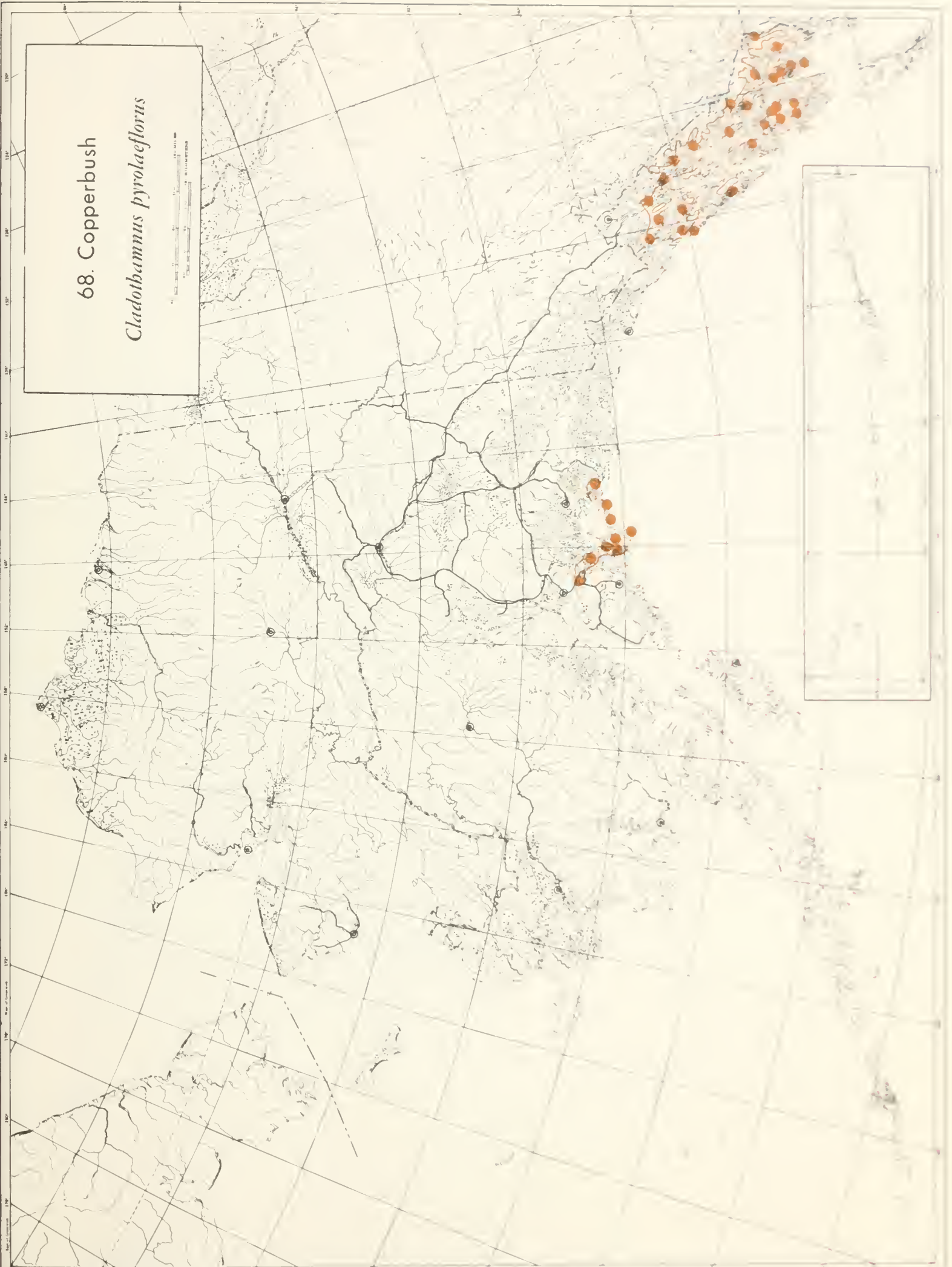
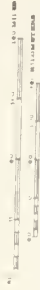
67. Leatherleaf

Chamaedaphne calyculata



68. Copperbush

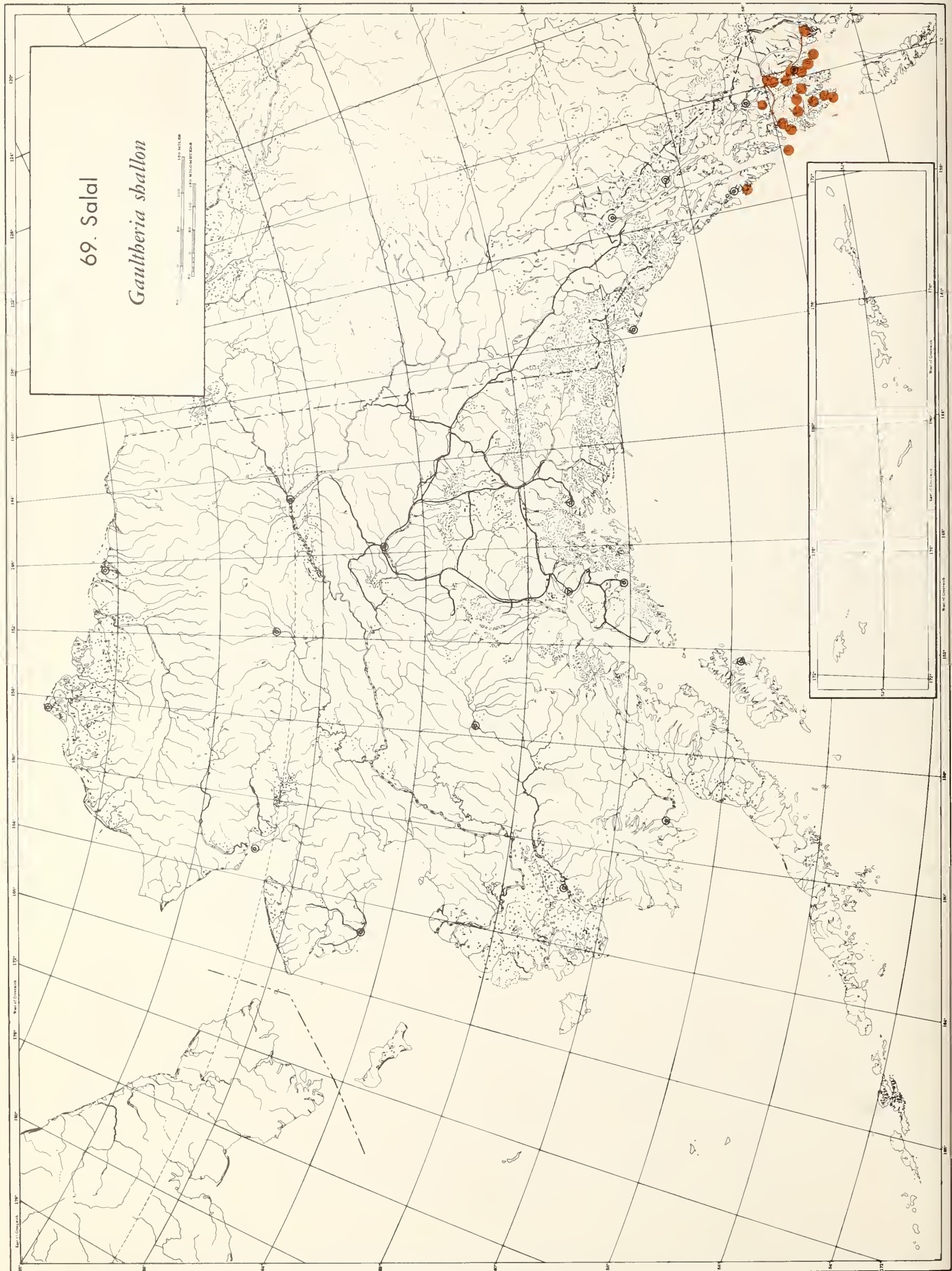
Cladobannus pyrolaeiflorus



69. Salal

Gaultheria shallon

0 500 1000 METERS
0 100 200 MILES



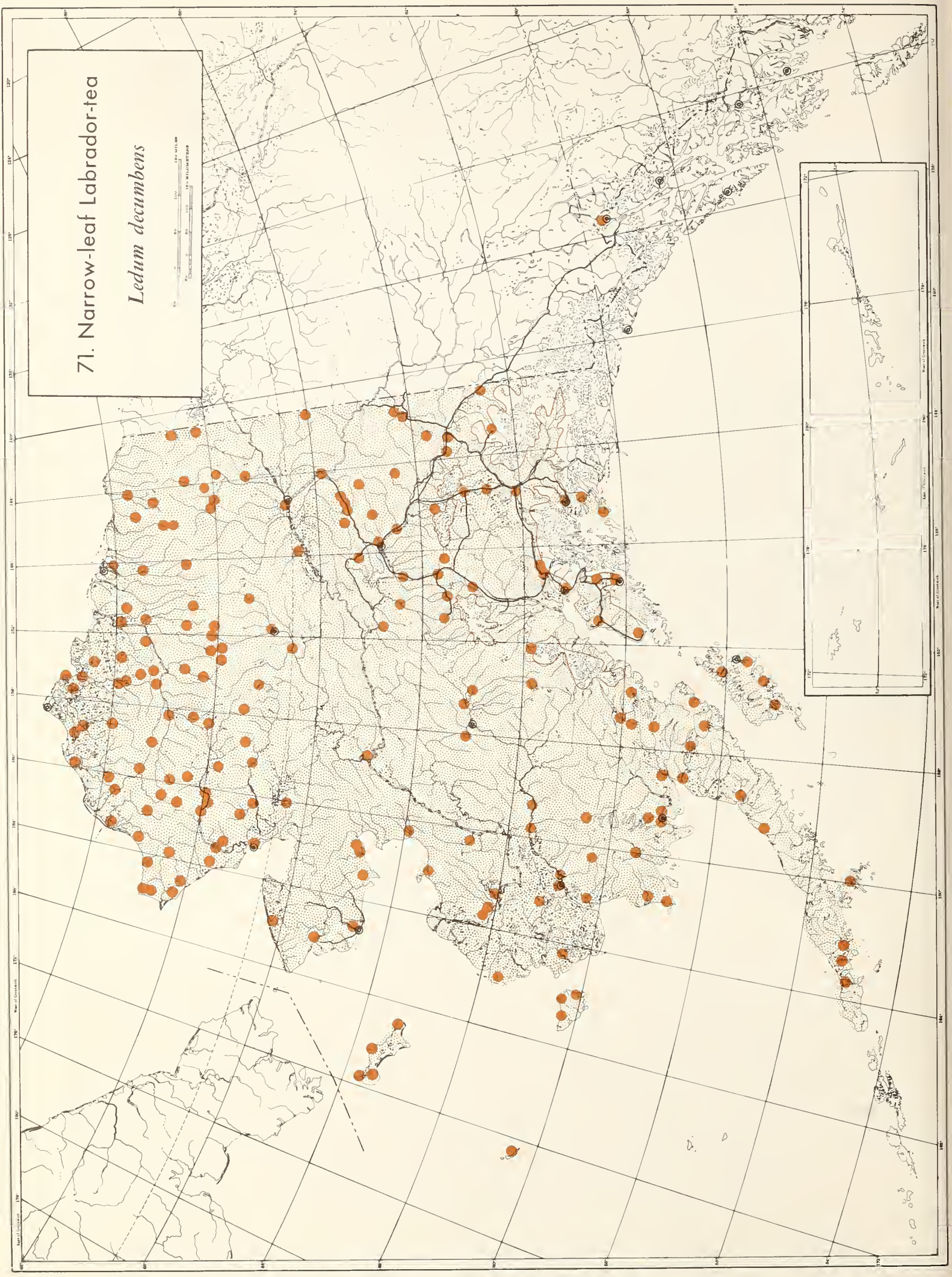
70. Bog kalmia

Kalmia polifolia



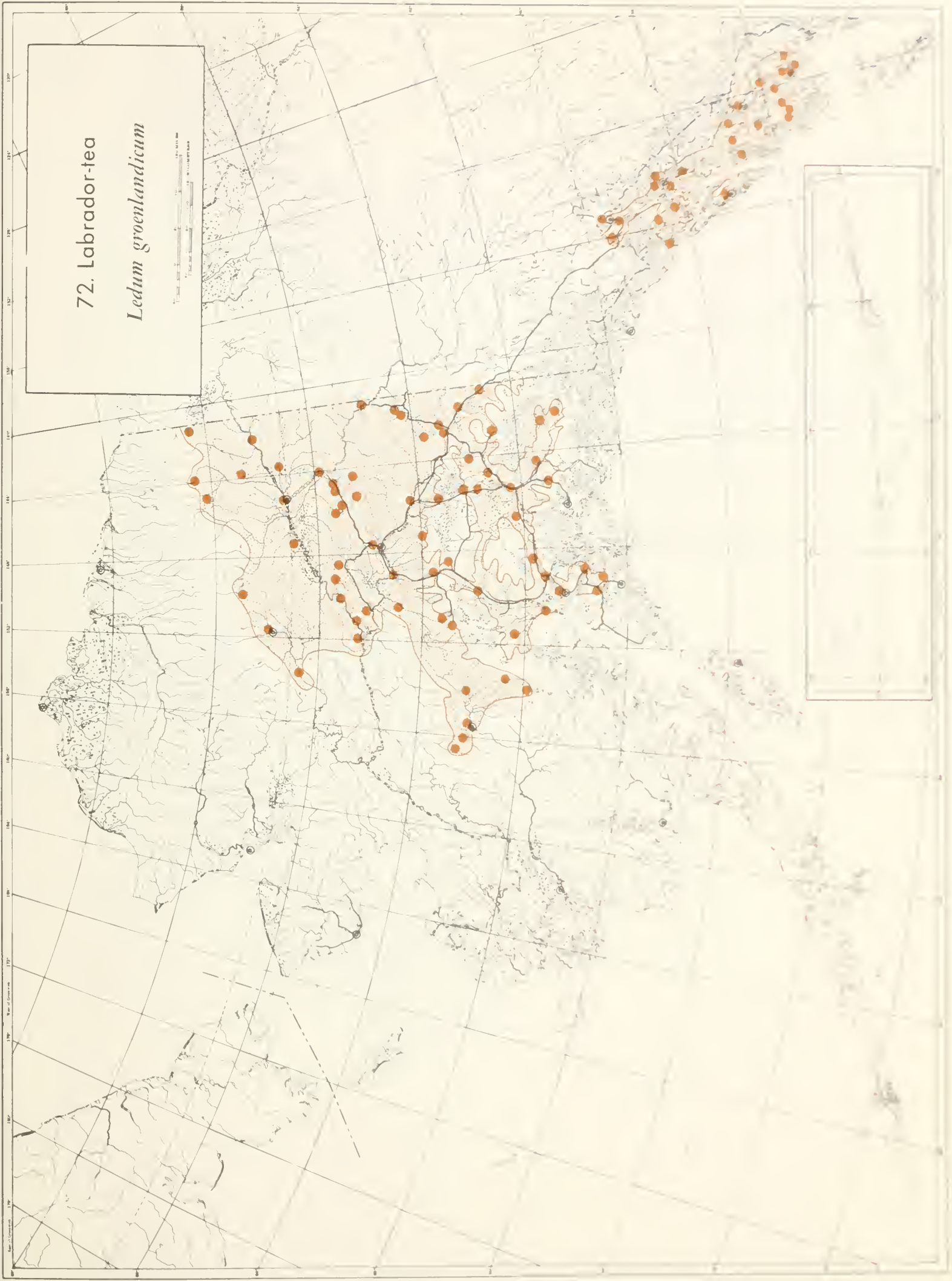
71. Narrow-leaf Labrador-tea

Ledum decumbens



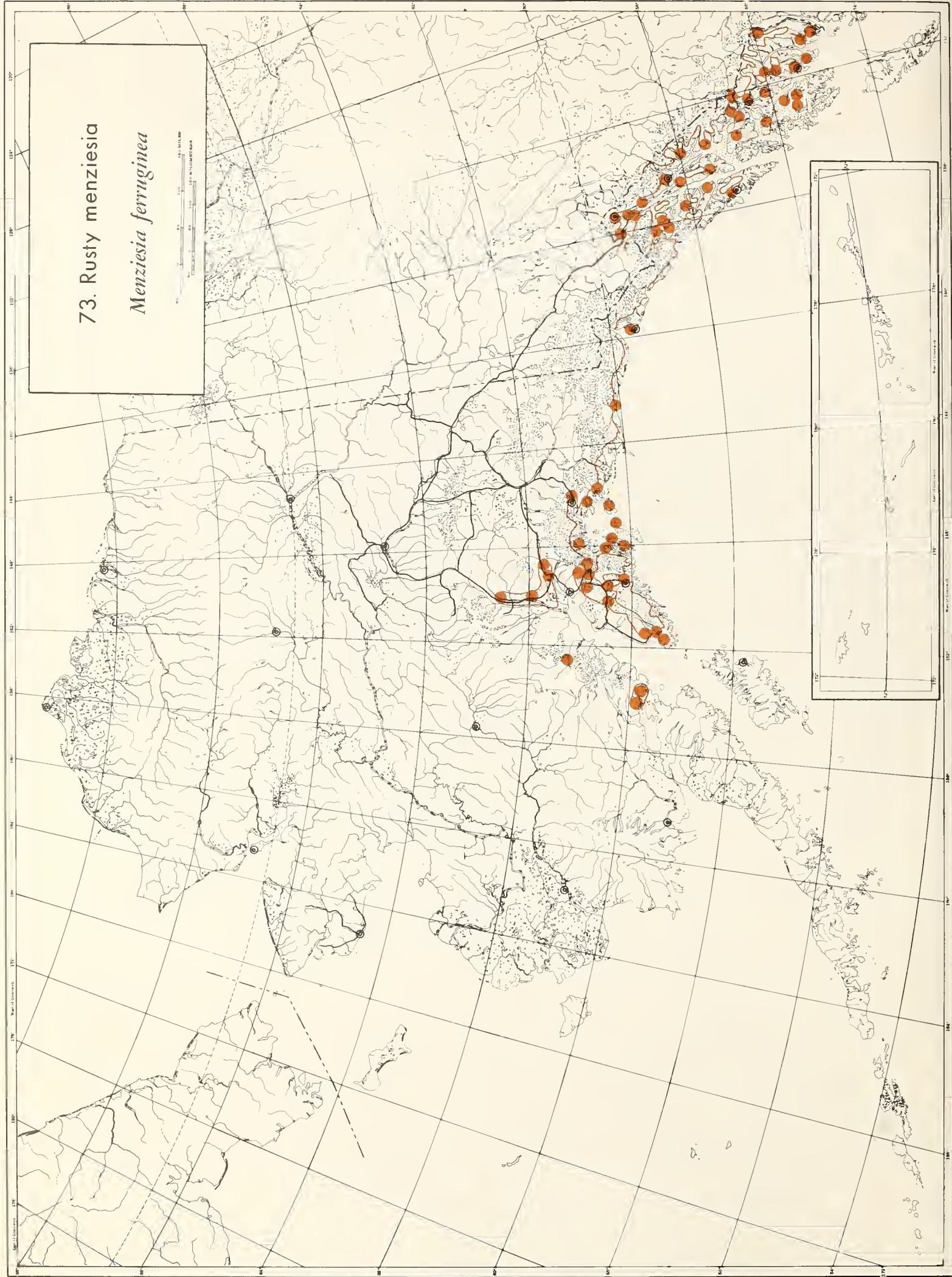
72. Labrador-tea

Ledum groenlandicum



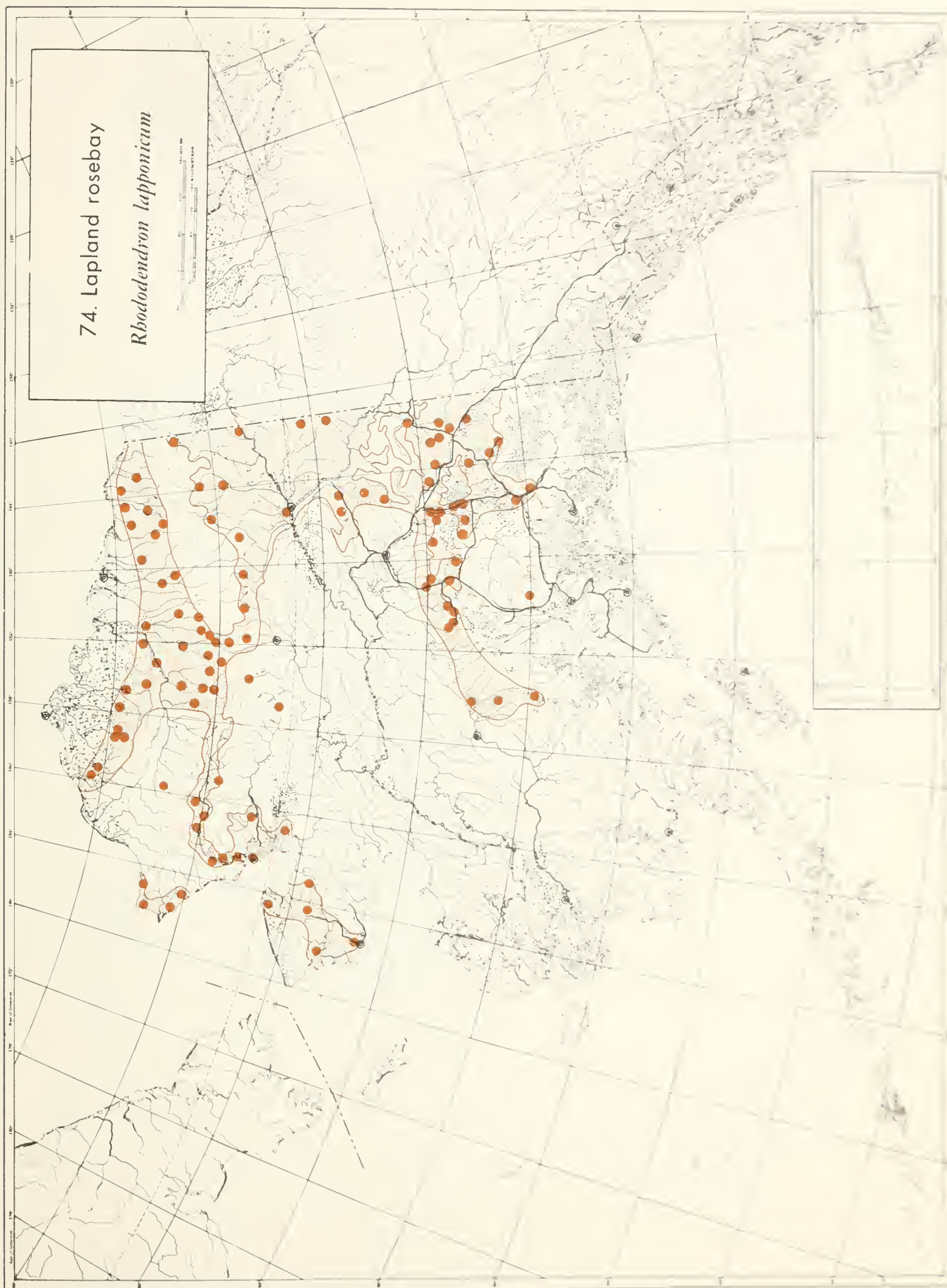
73. Rusty menziesia

Menziesia ferruginea



74. Lapland rosebay

Rhododendron lapponicum



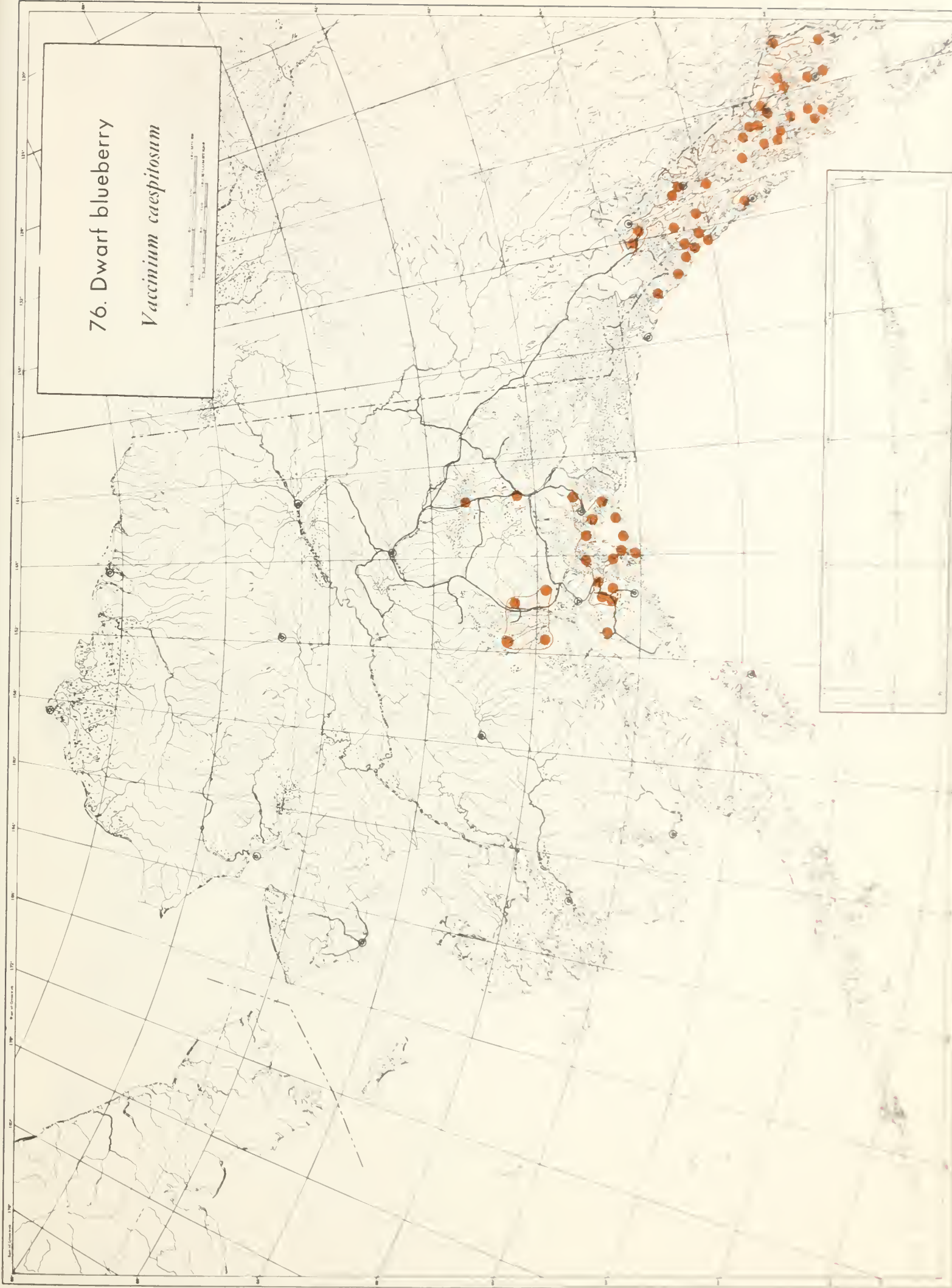
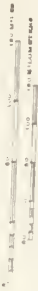
75. Alaska blueberry

Vaccinium alaskaense

1:50,000
1:100,000
1:200,000
1:400,000
1:800,000
1:1,600,000
1:3,200,000
1:6,400,000
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1:102,400,000
1:204,800,000
1:409,600,000
1:819,200,000
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1:3,276,800,000
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1:13,107,200,000
1:26,214,400,000
1:52,428,800,000
1:104,857,600,000
1:209,715,200,000
1:419,430,400,000
1:838,860,800,000
1:1,677,721,600,000
1:3,355,443,200,000
1:6,710,886,400,000
1:13,421,772,800,000
1:26,843,545,600,000
1:53,687,091,200,000
1:107,374,182,400,000
1:214,748,364,800,000
1:429,496,729,600,000
1:858,993,459,200,000
1:1,717,986,918,400,000
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76. Dwarf blueberry

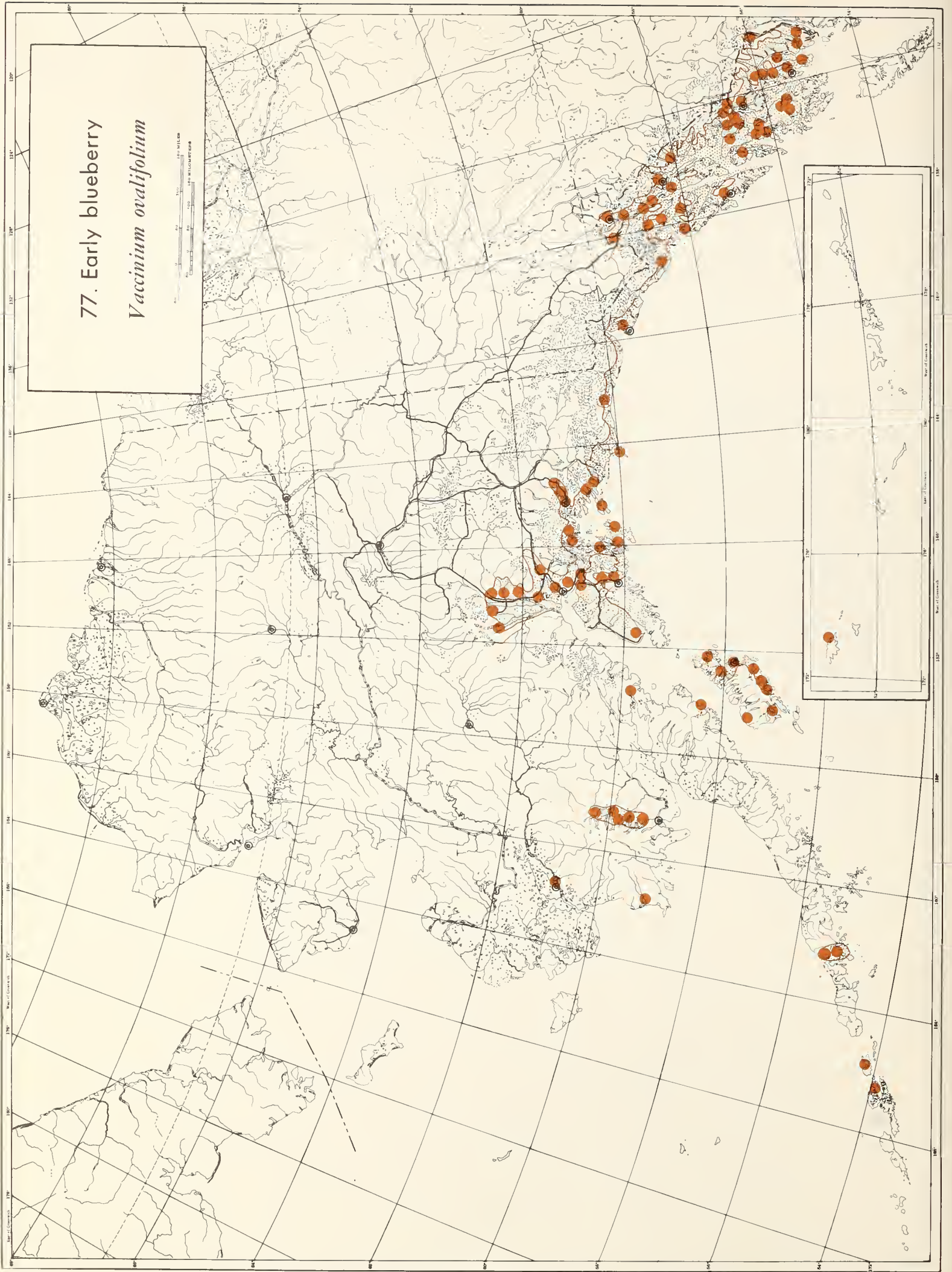
Vaccinium caespitosum



77. Early blueberry

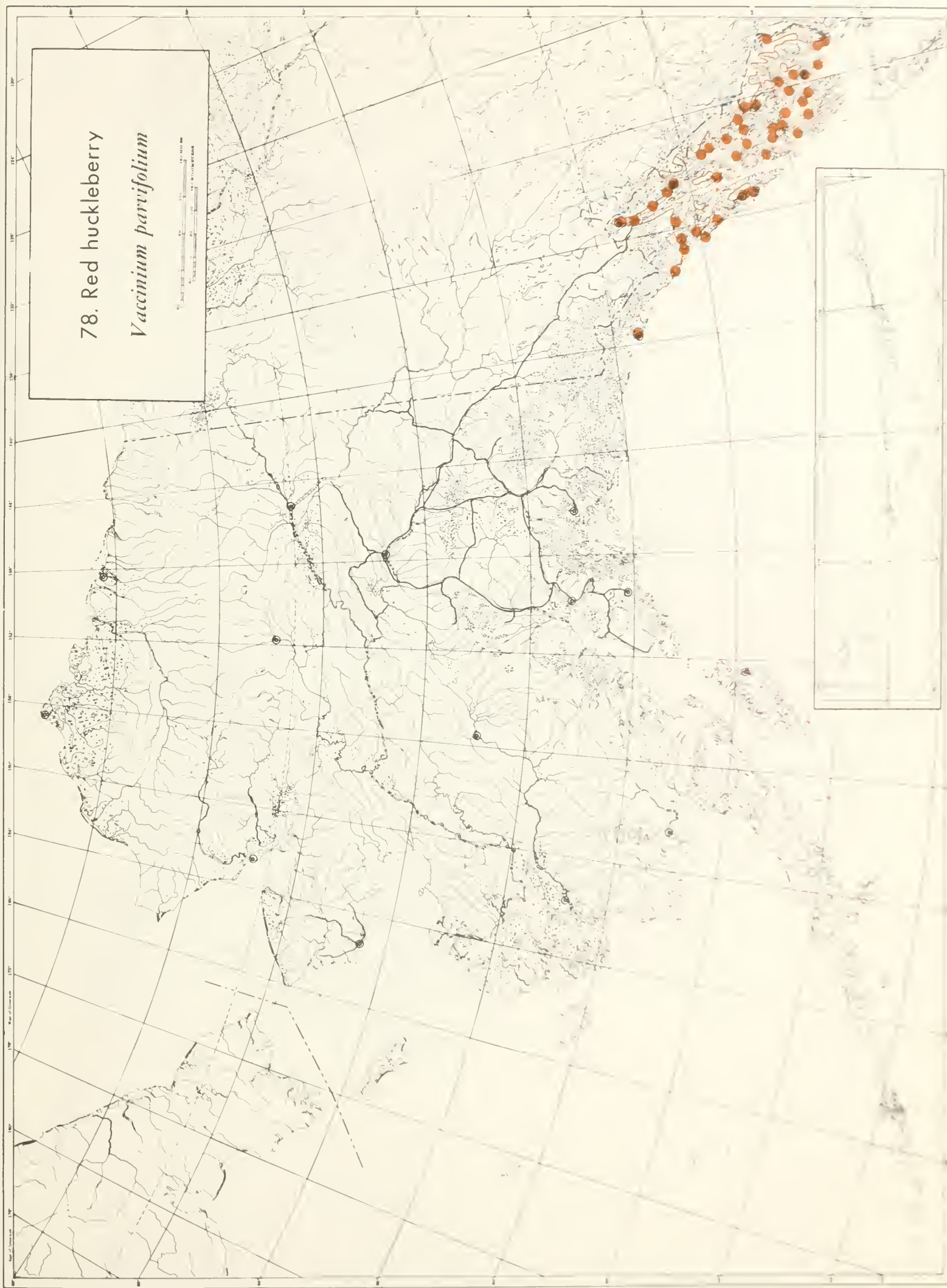
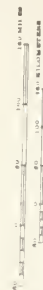
Vaccinium ovalifolium

Scale: 1:100,000
1:200,000
1:400,000
1:800,000
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78. Red huckleberry

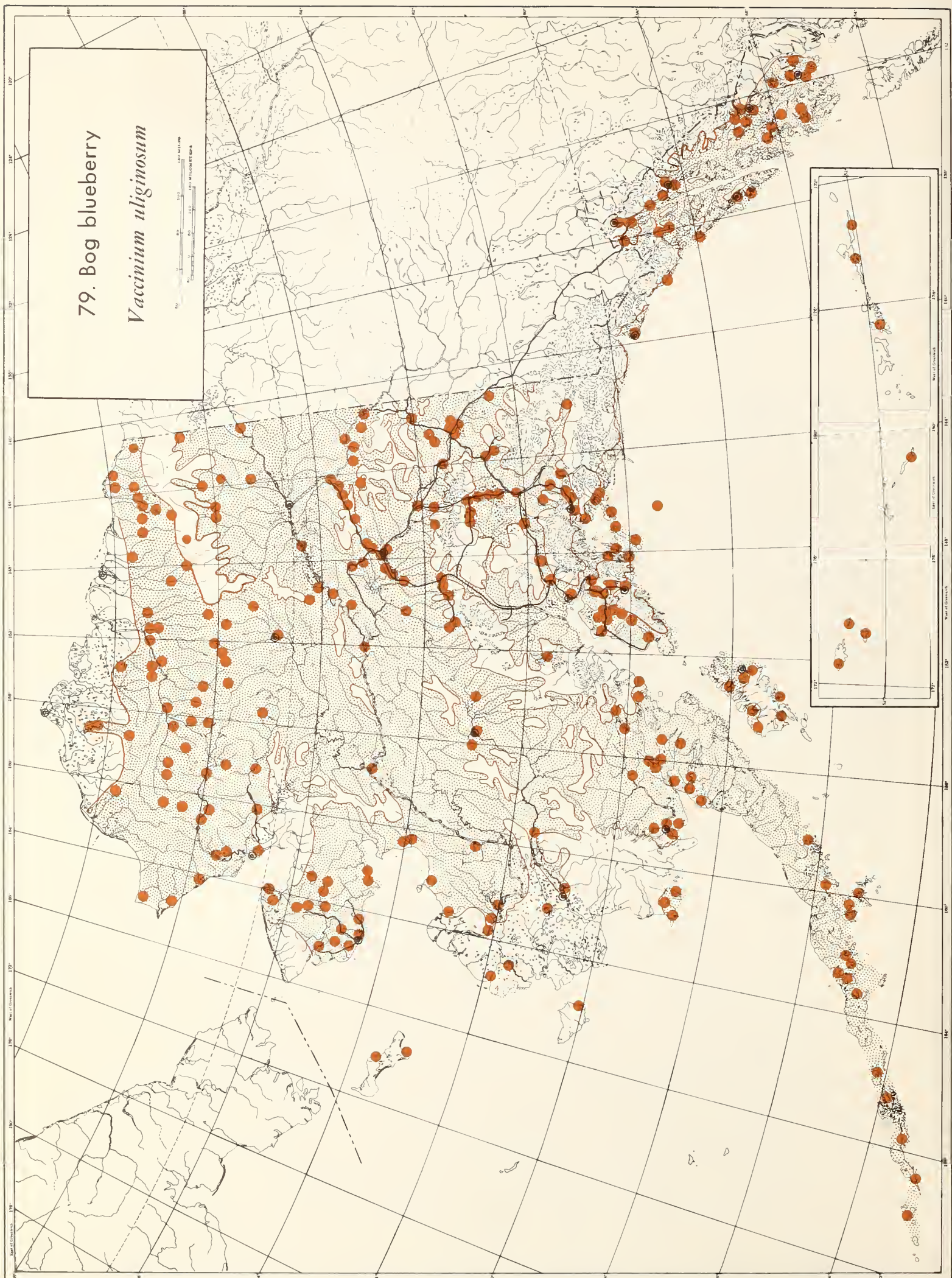
Vaccinium parvifolium



79. Bog blueberry

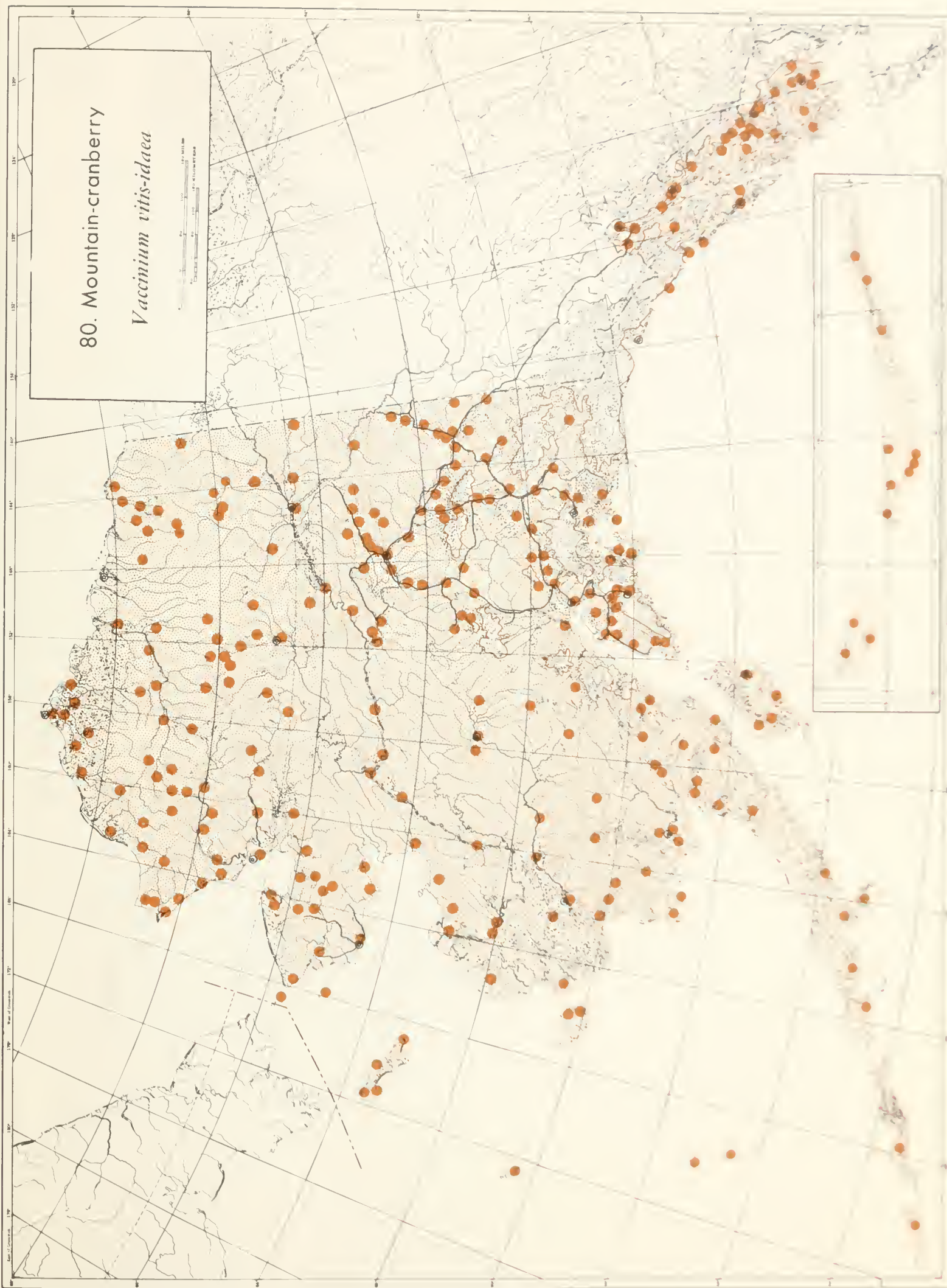
Vaccinium uliginosum

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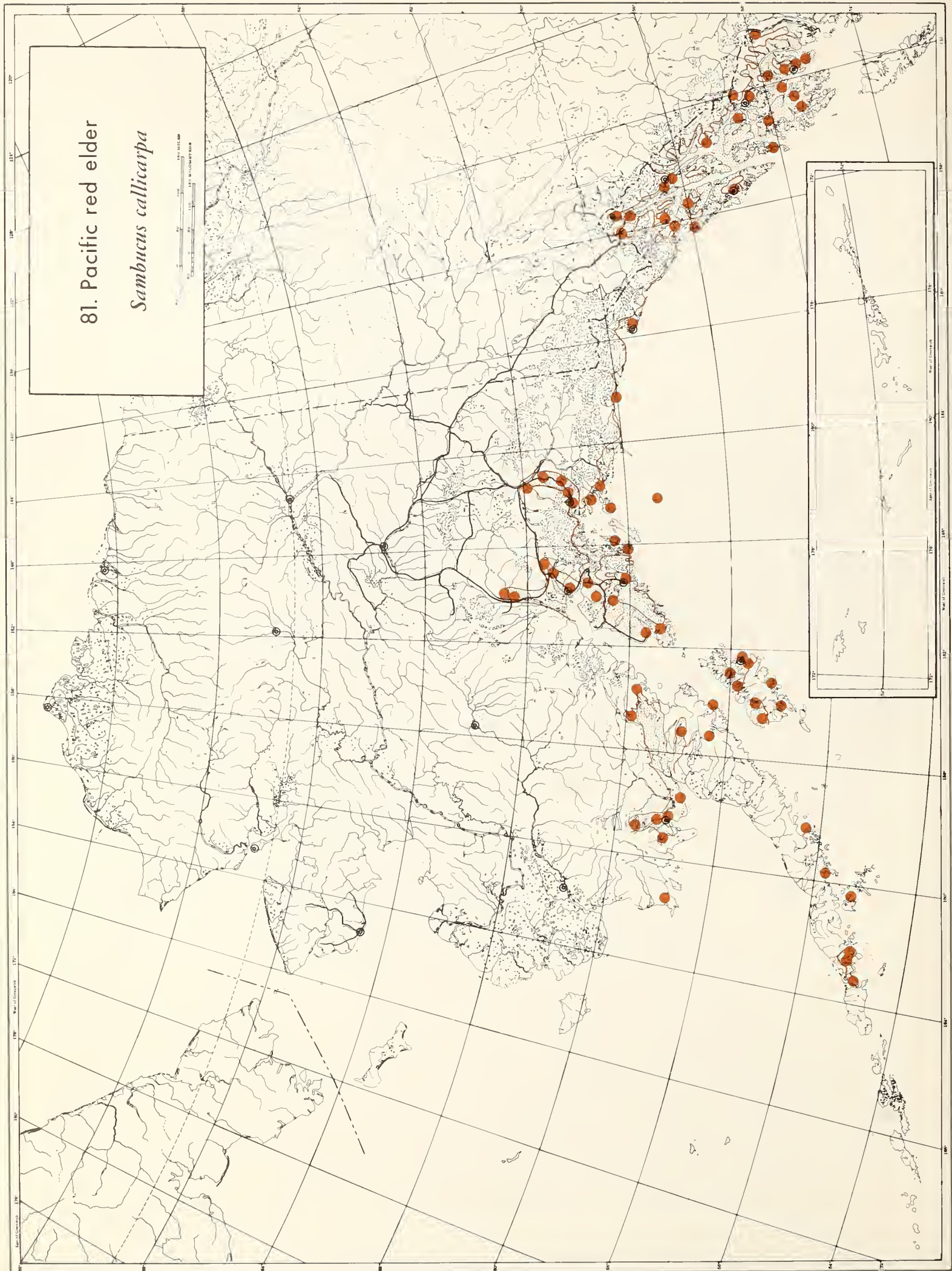


80. Mountain-cranberry

Vaccinium vitis-idaea

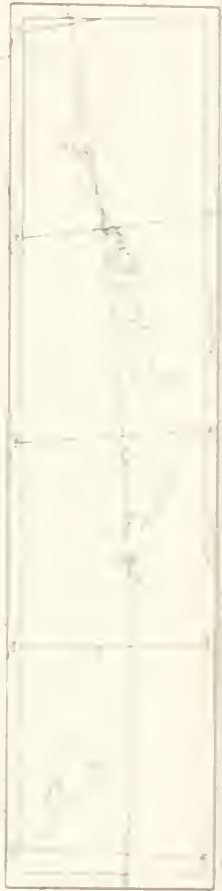
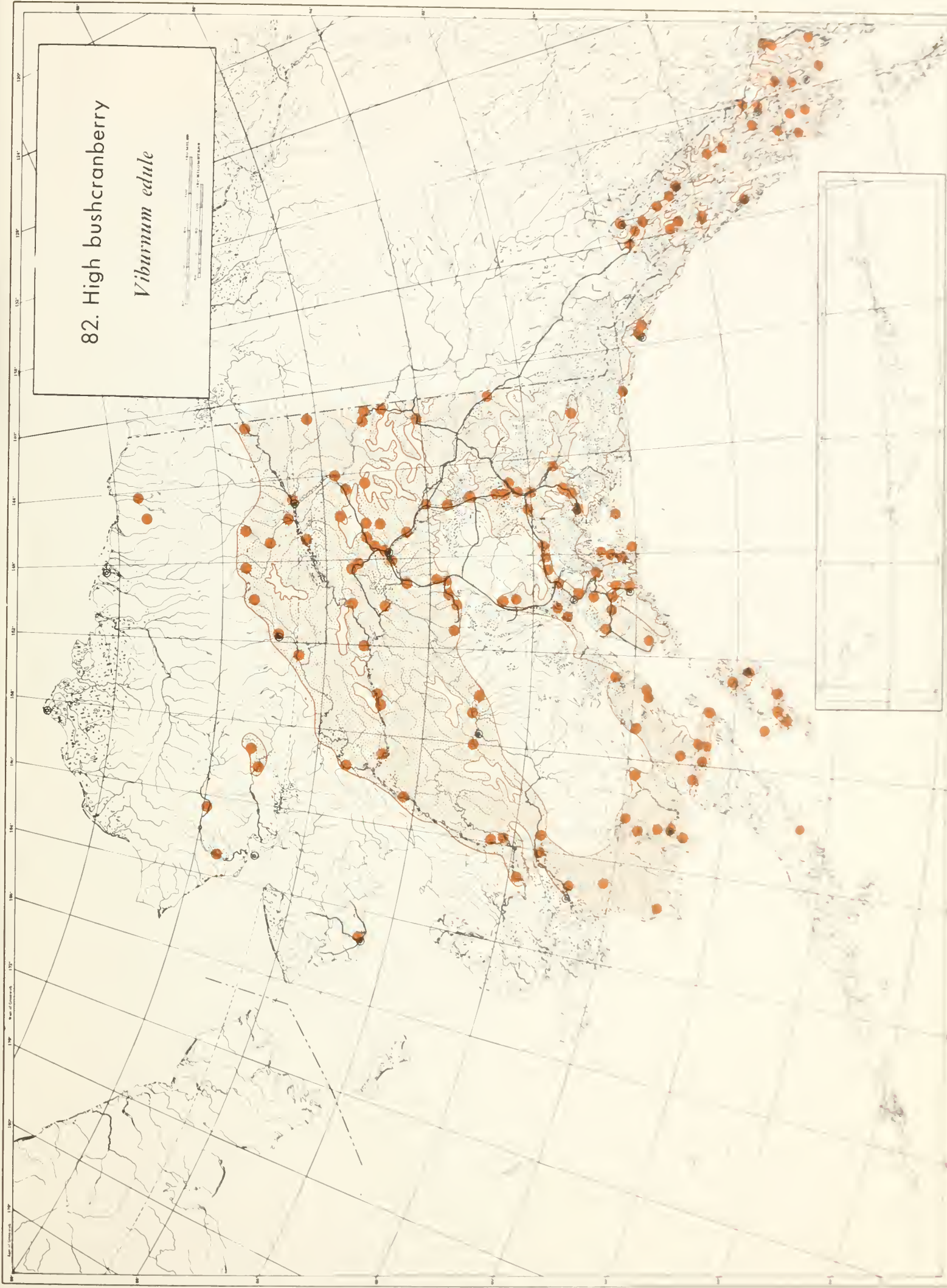


81. Pacific red elder
Sambucus callicarpa



82. High bushcranberry

Viburnum edule



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ABOUT THE FOREST SERVICE

As our Nation grows, people expect and need more from their forests—more wood; more water, fish and wildlife; more recreation and natural beauty; more special forest products and forage. The Forest Service of the U.S. Department of Agriculture helps to fulfill these expectations and needs through three major activities.

- Conducting forest and range research at over 75 locations ranging from Puerto Rico to Alaska to Hawaii.
- Participating with all State forestry agencies in cooperative programs to protect, improve, and wisely use our Country's 395 million acres of State, local, and private forest lands.
- Managing and protecting the 187-million acre National Forest System.

The Forest Service does this by encouraging use of the new knowledge that research scientists develop; by setting an example in managing, under sustained yield, the National Forests and Grasslands for multiple use purposes; and by cooperating with all States and with private citizens in their efforts to achieve better management, protection, and use of forest resources.

For more than 60 years, the Forest Service has been serving the Nation as a leading natural resource conservation agency.



