

FOREST INSECT AND DISEASE SURVEYS
IN THE NORTHWESTERN REGION
OF ONTARIO, 1976

M. J. THOMSON AND R. J. SAJAN

GREAT LAKES FOREST RESEARCH CENTRE
SAULT STE. MARIE, ONTARIO

CANADIAN FORESTRY SERVICE
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*Copies of this report may be obtained
from:*

*Information Office,
Great Lakes Forest Research Centre,
Canadian Forestry Service,
Department of Fisheries and
the Environment,
Box 490, Sault Ste. Marie, Ontario.
P6A 5M7*



Frontispiece. Clusters of egg bands of the forest tent caterpillar, *Malacosoma disstria* Hbn., on the branch tips of a trembling aspen tree near Sidney Lake, Red Lake District.

SURVEY HIGHLIGHTS

This report describes the more important forest insect and tree disease conditions in the Northwestern Region in 1976. The area showing spruce budworm infestation was double that of 1975, and there was a fourfold increase in the extent of forest tent caterpillar defoliation. Infestations of the yellow-headed spruce sawfly and an aspen leafroller also increased and caused severe defoliation of some spruce and aspen stands. In contrast, infestations of the balsam-fir sawfly and larch sawfly waned.

Severe damage and mortality of spruce seedlings caused by a species of snow mold showed up again in the Dryden Forest Station. From samples of affected seedlings and branches from adjacent spruce windbreaks submitted to the Great Lakes Forest Research Centre, the fungus *Lophophacidium hyperboreum* was tentatively identified from cultures. Sanitation measures were taken in midsummer and a suitable fungicide was applied late in the fall. It is hoped that a significant reduction in damage levels will be realized in 1977. In the southern part of the Region drought damage in the form of crown damage and mortality of jack pine and red pine worsened on high, rocky sites and extended over a larger area than in 1975. A search was again made for symptoms of Dutch elm disease in the southern part of the Region but none was found.

M. J. Thomson
Supervisor

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INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

The results of damage surveys, population sampling, and egg-mass counts have been included with those of other regions in a special report by G. M. Howse et al. (Report O-X-260). This report provides a complete description and analysis of developments in the spruce budworm situation in Ontario in 1976 and gives infestation forecasts for the province for 1977.

Eastern Pine Shoot Borer, *Eucosma gloriola* Heinrich

After more than a decade of negligible damage this insect was found to be troublesome in a number of young stands of jack pine (*Pinus banksiana* Lamb.). Surveys were carried out in numerous young stands throughout the summer of 1976 and among the stands found to be infested, the proportion of trees with damaged leaders ranged from 5 to 11% (Table 1). Lateral shoots were also commonly attacked but the damage to these is negligible compared with damage to the terminal leader, and therefore was ignored.

Table 1. Summary of damage on regeneration jack pine by the eastern pine shoot borer in three districts of Northwestern Region (counts based on the examination of 100+ randomly selected trees 3-6 cm^a DBH).

| Location | Avg DBH of sample trees (cm) ^a | Proportion of trees with damaged leaders (%) |
|-----------------------|---|--|
| Dryden District | | |
| Buller Twp | 5 | 6 |
| Ignace District | | |
| Martin Siding | 3 | 5 |
| Paguchi Lake | 5 | 11 |
| Fort Frances District | | |
| Glenorchy Rd | 5 | 6 |

^a 1 cm = 0.39 in.

Aspen Leafblotch Miner, *Lithocolletis ontario* Free.

An increase in damage to the foliage of regenerated aspen (*Populus* spp.) was evident for the second consecutive year in the south-eastern portion of the Region. Heavy infestations recurred near Martin Siding, Ignace District and pockets of moderate-to-severe defoliation were recorded at scattered locations in the Ignace, Sioux Lookout and Fort Frances districts (see Appendix, Fig. A1). Low levels of damage were observed at various points elsewhere in the Region.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The forest tent caterpillar infestation enlarged considerably for the second consecutive year. Aerial mapping revealed moderate-to-severe defoliation of aspen stands within approximately 24,605 km² (9,500 sq. mi) of forest land in the Red Lake, Kenora and Dryden districts, compared with 5,200 km² (2,000 sq. mi) in 1975 (see Appendix, Fig. A2).

In the Red Lake and Kenora districts the infestation extended east of the Ontario-Manitoba border from the south shore of Shoal Lake northward almost to the 13th base line. From here the infestation boundary ran south and east to Trout Lake and thence generally in a southwestern direction to Lake of the Woods just east of Kenora. In the western part of the Dryden District a heavy infestation was mapped near Willard Lake and the infestation which has persisted in the Dryden area for the past several years increased in size by one third. Elsewhere small isolated pockets of light infestation were mapped.

Larval populations were extremely high in some areas; e.g., aspen trees in a mixed stand 6.5 km (4 mi) south of Red Lake were denuded of foliage almost as soon as the buds flushed, and many larvae starved. A similar condition was noted on the northern boundary of the Dryden infestation. Large numbers of moths were observed in towns and villages where they had been attracted to lights, and many lake and river surfaces were littered with spent moths.

Dissections made at seven points revealed that, over all, moths emerged from 66% of the cocoons, an increase of 19% over 1975 (Table 2). Emergence ranged from a low of 46% in the older Dryden infestation to a high of 88% in the newly infested area at Red Lake.

Counts were made of the number of overwintering egg bands on trembling aspen (*Populus tremuloides* Michx.) within and along the eastern fringe and east and south of the infestation (Table 3). These indicate that the infestation covers the same parts of the Red Lake, Kenora and Dryden districts as were infested in 1975, as well as adjacent areas east of the main body of infestation, e.g., around Ear Falls

and between the towns of Dryden and Sioux Lookout (see Frontispiece and Appendix, Fig. A3).

Provided that spring weather favors the hatching of eggs and the survival of young caterpillars, infestations are likely to interrupt recreational activities during late May and in June. High-use areas such as provincial parks that have an appreciable content of trembling aspen can be treated to diminish the nuisance of wandering caterpillars.

Table 2. Results of forest tent caterpillar cocoon dissections in 1975 and 1976 in the Northwestern Region (100 cocoons dissected at each location).

| Location | Parasitized (%) | | Diseased or Unknown (%) | | Adult emergence (%) | |
|--------------------|-----------------|------|-------------------------|------|---------------------|------|
| | 1975 | 1976 | 1975 | 1976 | 1975 | 1976 |
| Red Lake District | | | | | | |
| Bruce Lake | 61 | 45 | 2 | 4 | 37 | 51 |
| Murdock Lake | - | 19 | - | 6 | - | 75 |
| Nungesser Lake | - | 23 | - | 5 | - | 72 |
| Red Lake | - | 8 | - | 4 | - | 88 |
| Sydney Lake | - | 10 | - | 8 | - | 82 |
| Kenora District | | | | | | |
| Hwy 17 at Kenora | - | 33 | - | 18 | - | 49 |
| Hwy 17 at Eagle R. | - | 49 | - | 5 | - | 46 |

Balsam Fir Sawfly, *Neodiprion abietis* complex

Defoliation of balsam fir (*Abies balsamea* [L.] Mill.) caused by this sawfly decreased in 1976. Severe damage was confined to a small area along Highway 105 in Buller Township, Dryden District, where approximately 90% defoliation occurred in the top third of balsam fir tree crowns. Elsewhere, trace defoliation was observed on fringe trees at numerous points in the Region.

Pine Sawflies, *Neodiprion nanulus nanulus* Schedl and *N. virginianus* complex

Surveys revealed that populations of pine sawflies were generally low, except in Echo Township Wilderness Area, Sioux Lookout District where a pocket of *N. nanulus nanulus* caused light-to-moderate defoliation on small understory red pine (*Pinus resinosa* Ait.). Colony counts averaged three per tree in the area.

Table 3. Summary of forest tent caterpillar egg-band counts and infestation forecasts in the Northwestern Region (counts based on the examination of one to three trees at each location).

| Location (see Appendix, Fig. A3) | Avg DBH of sample trees (cm) ^a | No. of trees exa- mined | Avg no. of egg bands per tree | Infes- tation forecast for 1977 |
|--|--|----------------------------------|--|--|
| Red Lake District | | | | |
| Cairns Lake (1) | 15 | 1 | 93 | heavy |
| Trout Lake (2) | 15 | 1 | 141 | heavy |
| Sydney Lake (3) | 15 | 1 | 337 | heavy |
| Bruce Lake (4) | 15 | 1 | 26 | heavy |
| Camping Lake (5) | 15 | 1 | 59 | heavy |
| Sioux Lookout District | | | | |
| Echo Twp (1) | 13 | 3 | 7 | heavy |
| Kenora District | | | | |
| Big Canyon Lake (1) | 15 | 3 | 13 | heavy |
| Victoria Island | | | | |
| Lake of the Woods (2) | 13 | 1 | 21 | heavy |
| Dryden District | | | | |
| Feist Lake (1) | 15 | 3 | 7 | heavy |
| Hwy 17 at | | | | |
| Eagle River (2) | 15 | 3 | 10 | heavy |
| Pritchard Lake (3) | 13 | 3 | 5 | moderate |
| Hartman Lake (4) | 13 | 3 | 7 | heavy |
| Fort Frances District | | | | |
| Lake of the Woods | | | | |
| Prov. Pk. (1) | 13 | 3 | 1 | light |
| Caliper Lake | | | | |
| Prov. Pk. (2) | 15 | 3 | 1 | light |
| Hwy 11 east of | | | | |
| Glenorchy (3) | 15 | 3 | 0 | negative |

^a 1 cm = 0.39 in.

Yellow-headed Spruce Sawfly, *Pikonema alaskensis* Roh.

A marked increase in population levels of this sawfly occurred within the Region, particularly in the Fort Frances District (see Appendix, Fig. A4).

Ornamental spruces (*Picea* spp.) within the town of Fort Frances were heavily attacked, and many inquiries were received from concerned homeowners. Severe defoliation of young white spruce (*Picea glauca* [Moench] Voss) also occurred in a plantation in Kingsford Township, at Caliper Lake Provincial Park, and in windbreaks along Highway 71 near Finland in the Fort Frances District. Some tree mortality could result near Finland, especially if the infestation persists. Severe damage also occurred at Rushing River Provincial Park, Kenora District.

Light-to-moderate defoliation occurred in Lake of the Woods Provincial Park and along Highway 11, in the Bear Pass area, Fort Frances District. Low numbers were recorded in the southwest portion of the Red Lake District, the Watcomb Lake area of the Ignace District, and along Highway 17, west of Kenora.

White Pine Weevil, *Pissodes strobi* (Peck)

There was little change in the incidence of weevil attack on pines (*Pinus* spp.) in 1976. The average number of tree leaders affected in regeneration sites examined was 4.4%, compared to 3.4% in 1975. The highest level of damage was in Kingsford Township, Fort Frances District, where 10% of regeneration white pine (*Pinus strobus* L.) was weeviled (Table 4).

Larch Sawfly, *Pristiphora erichsonii* (Htg.)

Infestations of this sawfly have caused significant levels of damage to tamarack (*Larix laricina* [Du Roi] K. Koch) in the eastern portion of the Region for the past two years, but populations declined sharply in 1976. A small pocket of moderate-to-severe defoliation was detected at Robinet Lake, northwest of Pickle Lake, Sioux Lookout District. Surveys in numerous stands elsewhere revealed that egg laying was common, but larval colonies disappeared soon after egg hatch and only initial defoliation was noted.

Aspen Leafroller, *Pseudexentera oregonana* Wlshm.

A marked increase was noted in the area infested by this leafroller in the Fort Frances District. Two areas of 75-80% defoliation were mapped. One area of approximately 10 km² (4 sq. mi) was located

east of Rat River Bay on the north side of Rainy Lake, and the second area, approximately 8 km² (3 sq. mi) in size, was situated in the Blaze Point-Sunday Island area of the above lake. In 1975 only one pocket of infestation 1 ha (2.47 acres) in size with 30% defoliation was reported. Small pockets of light-to-moderate defoliation also occurred at Shoal Lake, at Reef Point in Rainy Lake, and in Devlin and Pratt townships, Fort Frances District.

Table 4. Summary of damage by the white pine weevil in four districts of the Northwestern Region in 1975 and 1976 (counts based on the examination of 100+ randomly selected trees 3-5 cm^a DBH).

| Location | Host | Trees weeviled (%) | |
|------------------------|------|-----------------------|------|
| | | 1975 | 1976 |
| Sioux Lookout District | | | |
| Drayton Twp | jP | 5 | 3 |
| Dryden District | | | |
| Buller Twp | jP | 3 | 2 |
| Ignace District | | | |
| Basket Lake Rd | jP | 1 | 1 |
| Hwy 599 at Crystal R. | jP | 4 | 3 |
| Martin Siding | jP | 2 | 3 |
| Paguchi Lake | jP | 6 | 8 |
| Fort Frances District | | | |
| Bowes Camp Rd | jP | 3 | 5 |
| Kingsford Twp | wP | - | 10 |

^a 1 cm = 0.39 in.

Table 5. Other forest insects

| Insect | Host(s) | Remarks |
|---|---------|--|
| <i>Anchylopera burgessiana</i> Zell. | r0 | a few trees severely defoliated at Nestor Falls, and in Woodyatt Twp, Fort Frances District, and on islands in the southern portion of Lake of the Woods |

(continued)

Table 5. Other forest insects (concluded)

| Insects | Host(s) | Remarks |
|---|-------------------|---|
| <i>Argyresthia thuiella</i> Pack. | eC | low numbers collected on the south shore of Eltrut Lake, Fort Frances District |
| <i>Coleophora laricella</i> Hbn. | tL | low numbers on roadside windbreaks in Lash Twp east of the town of Emo, Fort Frances District |
| <i>Conophthorus banksianae</i> McPherson | jP | Population and damage levels remained low in the Region. |
| <i>Dryocampa rubicunda rubicunda</i> Fabr. | rM | common along the Manitou Access Rd, Fort Frances District |
| <i>Eupareophora parca</i> (Cress.) | bAs | occasional colonies on fringe trees in the Windy Point and Bear Pass areas, Fort Frances District |
| <i>Hyphantria cunea</i> Dru. | wE, W, wB, cCh | scattered colonies at numerous locations in Fort Frances District |
| <i>Malacosoma californicum pluviale</i> Dyar | pCh | occasional colonies observed in Sioux Lookout, Red Lake, Kenora and Fort Frances districts |
| <i>Petrova albicapitana</i> (Busck.) | jP | common and widely distributed throughout the Region |
| <i>Pulicalvaria thujaella</i> (Kft.) | eC | low numbers on roadside windbreaks in Dilke Twp, Fort Frances District |

TREE DISEASES

Needle Rusts of Spruce, *Chrysomyxa ledi* (Alb. and Schw.) d By., and *C. ledicola* Lagh.

A special foliage disease survey was carried out to determine distribution, incidence and damage levels of needle rusts of spruces. Foliage disease evaluations were conducted within randomly selected stands in 11 preselected areas. In addition, 200 trees were examined in each of eight systematically selected stands to determine the incidence and level of infection. The diseases were widely distributed and infected trees were found in all but one of the stands examined. Despite the wide range of incidence recorded, foliage damage did not exceed the trace levels and stand damage levels were negligible (Table 6). Disease identifications made at the Great Lakes Forest Research Centre in Sault Ste. Marie showed that two thirds of the stands examined were infected by *C. ledi* and one third by *C. ledicola*.

Jack Pine Needle Cast, *Davisomycella ampla* (Davis) Darker

Surveys for *D. ampla*, a foliage disease of jack pine, were carried out in conjunction with spruce rust surveys at 11 predetermined sample points and at an additional 16 randomly selected points to determine levels and distribution of this disease.

The disease was found at four of the 27 points examined. The level of infection was moderate on the fringe of a young jack pine stand in Revel Township, Ignace District, and trace in one stand in each of Lomond and Pelican townships and along the Glenorchy Rd. in Sioux Lookout, Kenora and Fort Frances districts.

Western Gall Rust of Hard Pines, *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka

This gall-forming rust was common in jack pine stands throughout the Region, but little change in infection levels has occurred over the past several years. Infections occurred on trees in all age classes, but the most serious damage was to the smaller diameter trees with stem infections. Portions of tree crowns above the gall may be killed.

Stands in the Nungesser Lake area of the Red Lake District had the greatest damage and mortality in the Region (see Appendix, Fig. A5, and Table 7).

At the OMNR Forest Station in Dryden, 10 to 15% of the 2-0 jack pine stock lifted for outplanting were affected by small galls at the root collar, a condition typical of early infection by this disease on nursery stock.

Table 6. Summary of incidence and defoliation levels caused by needle rusts of spruce on black spruce (*Picea mariana* [Mill.] B.S.P.) in the Northwestern Region in 1976 (counts based on the examination of 100+ trees from 5-10 randomly selected sample plots).

| Location | Tree ht (m) ^a | Trees affected (%) | Defoliation levels (%) |
|-------------------------------|-----------------------------|--------------------------|------------------------------|
| Red Lake District | | | |
| Madsen Area | 10.6 | 15 | 3 |
| Manitou Falls Rd | 3.0 | 43 | 1 |
| Hwy 105 south of Ear Falls | 6.1 | 24 | 1 |
| Emarton Lake | 21.2 | 9 | 1 |
| Sioux Lookout District | | | |
| Hwy 642 east of Superior Jct. | 18.2 | 5 | 1 |
| Hwy 599 at Grebe Lake | 9.1 | 13 | 1 |
| Hwy 599 at Fitchie Lake | 5.8 | 66 | 1 |
| Little Savant River | 13.7 | 14 | 1 |
| Kenora District | | | |
| Hwy 71 at Andy Lake | 13.9 | 53 | 1 |
| Dryden District | | | |
| Hwy 105 at Perrault Falls | 21.2 | 50 | 1 |
| Hwy 105 at Red Lake Rd | 16.4 | 11 | 1 |
| Dryden Tree Nursery Rd | 14.2 | 21 | 1 |
| Ignace District | | | |
| Hwy 17 south of Notman Siding | 14.5 | 20 | 1 |
| Dewan Twp | 15.5 | 28 | 1 |
| Hwy 17 west of Martin Siding | 13.6 | 45 | 1 |
| Fort Frances District | | | |
| Mine Centre Area | 8.2 | 0 | 0 |
| Glenorchy Area | 9.1 | 1 | 1 |
| Hwy 11 at Nickel Lake Rd | 16.7 | 63 | 1 |
| Dance Twp | 6.4 | 82 | 3 |

^a 1 m = 3.28 ft

Table 7. Number of trees affected and damage levels of western gall rust in jack pine regeneration, Northwestern Region, 1976 (counts based on the examination of 100+ trees in 5-10 randomly selected sample plots in each area of natural regeneration examined).

| Location | Tree ht (m) ^a | Trees affected (%) | Trees severely affected ^b (%) | Tree mortality (%) |
|------------------------|-----------------------------|--------------------------|---|--------------------------|
| Red Lake District | | | | |
| Nungesser Lake Rd | 0.6 | 41 | 31 | 9 |
| Sioux Lookout District | | | | |
| Goodie Lake Rd | 1.8 | 18 | 8 | 0 |
| Marchington Access Rd | 1.2 | 27 | 14 | 1 |
| Ignace District | | | | |
| Basket Lake Rd | 1.2 | 15 | 1 | 2 |
| Fort Frances District | | | | |
| Glenorchy Rd | 3.0 | 8 | 2 | 0 |

^a 1 m = 3.28 ft

^b stem galls

Shoot Blight of Red Pine, *Sirococcus strobilinus* Preuss.

Two new small infection centers were found, one in roadside plantings near the junction of the Ormiston road and Highway 17 east of Kenora and the other along Highway 11, 9.6 km (6 mi) east of Fort Frances. Although this shoot blight occurs sporadically on regenerated trees throughout the range of red pine in the Region these infections represent the second and third time that it has been recorded on planted trees over the past 3 years.

Leaf and Twig Blight of Aspen, *Venturia macularis* (Fr.) Mueller & Arx (= *Pollaccia radiosa* [Lib.] Bald. & Cif.)

Tip damage to the leading shoots caused by this leaf and twig blight of aspen regeneration is common throughout most of the Region. The intensity of damage varied, but in most circumstances was low. The

heaviest damage occurred in Echo Township in Sioux Lookout District, where 57% of young aspens in 10 randomly selected sample plots were affected but only 3% showed evidence of tip blight (Table 8).

Table 8. Summary of damage caused by leaf and twig blight of aspen in four regeneration trembling aspen stands in the Northwestern Region in 1976 (counts based on the examination of 100+ trees in 5-10 randomly selected sample plots at each location).

| Location | Tree ht (m) ^a | Trees affected (%) | Terminal shoot mortality (%) |
|----------------------------|-----------------------------|--------------------------|------------------------------------|
| Red Lake District | | | |
| Hwy 105 at Two Island Lake | 0.9 | 5 | 1 |
| Sioux Lookout District | | | |
| Echo Twp | 1.8 | 57 | 3 |
| Mullen Lake | 2.1 | 2 | 1 |
| Ignace District | | | |
| Hwy 17 west of Raven Lake | 2.1 | 2 | 1 |

^a 1 m = 3.28 ft

Nursery Problem

Severe damage including some mortality of approximately 6.5 million rising 2-0 black spruce and white spruce seedlings, was apparently caused by a snow mold fungus at the OMNR Forest Station at Dryden.

Samples of infected material were collected from the nursery in early April and examined at the Great Lakes Forest Research Centre, Sault Ste. Marie, and at the Biosystematic Research Institute, Ottawa. It was concluded that the fungus responsible for the damage was probably *Lophophacidium hyperboreum* Lagerberg. However, spores of this fungus could not be found on foliage submitted to the Research Centre in late summer when fruiting was expected.

A sanitation program was initiated at the nursery during July and August, infected spruce seedlings were removed and the lower branches of spruce windbreaks were pruned to a height of 60-90 cm (2-3 ft). When tree survival was jeopardized by pruning or heavy infection, entire trees were completely removed. Owing in part at least to this sanitation program, the fruiting bodies required for positive

identification of the fungus could not be collected. In the late fall, compartments and windbreaks containing spruce were sprayed with a fungicide suitable for the treatment of snow mold.

Drought Damage

Aerial surveys throughout the southern portion of the Region indicated that deterioration of pines growing on high, rocky, shallow sites recurred and the heavily affected area doubled in size from 190 km² (75 sq. mi) in 1975 to approximately 420 km² (160 sq. mi) in 1976 (see Appendix, Fig. A6).

In some stands near Little Turtle Lake, Fort Frances District, an estimated 90% of the jack pine was severely affected and approximately 75% of the trees were dead. The examination of randomly selected dying jack pine in this area revealed that two species of wood borers, *Monochamus* sp. and *Sirex* sp., were present in moderate numbers.

Red pine along Highway 11, east of Mine Centre to Reef Point on Rainy Lake, Fort Frances District showed signs of deterioration, i.e., top dieback and browning of foliage, by late July and early August. On islands in the southern portion of Lake of the Woods, Kenora District, white pine and jack pine trees had similar symptoms and premature browning and leaf fall of aspen was evident throughout the affected area.

Table 9. Other forest diseases

| Organism | Host(s) | Remarks |
|--|---------|--|
| <i>Armillaria mellea</i> (Vahl. ex Fr.) Kummer | jP | trace damage levels causing mortality in jack pine regeneration along Basket Lake Rd, Ignace District |
| <i>Chrysomyxa arctostaphyli</i> Diet. | bS | trace damage recorded east of Mine Centre, Fort Frances District |
| <i>Coleosporium asterum</i> (Diet.) Syd. | rP | In conjunction with the foliage disease survey throughout the Region, this needle rust was found, at the trace defoliation level, south of Sioux Narrows, Kenora District. |

(continued)

Table 9. Other forest diseases (concluded)

| Organism | Host(s) | Remarks |
|---|---------|--|
| <i>Cronartium ribicola</i> J. C. Fischer ex. Rabh. | wP | light-to-moderate damage occurring throughout the southern portion of Lake of the Woods, and Rainy Lake area |
| <i>Gremmeniella abietina</i> (Lagerb.) Morelet (= <i>Scleroderris lagerbergii</i> Gremmen) | jP | Aerial surveys detected no new infection centers; However, considerable damage is still occurring in the Pineimuta River area, Sioux Lookout District. |
| A hypodermataceous needle cast | jP | low-to-moderate damage recorded in the southern portion of Sioux Lookout District, and moderate damage in McCrosson Twp, Fort Frances District |
| <i>Hypoxyylon mammatum</i> (Wahl.) Miller | tA | a 1% increase in mortality over 1975 recorded in the Impact Plot, Drayton Twp, Sioux Lookout District; common elsewhere in aspen stands |
| <i>Melampsorella caryophyllacearum</i> Schroet | bF | common at trace damage level at numerous points throughout the Region |

APPENDIX

NORTHWESTERN REGION

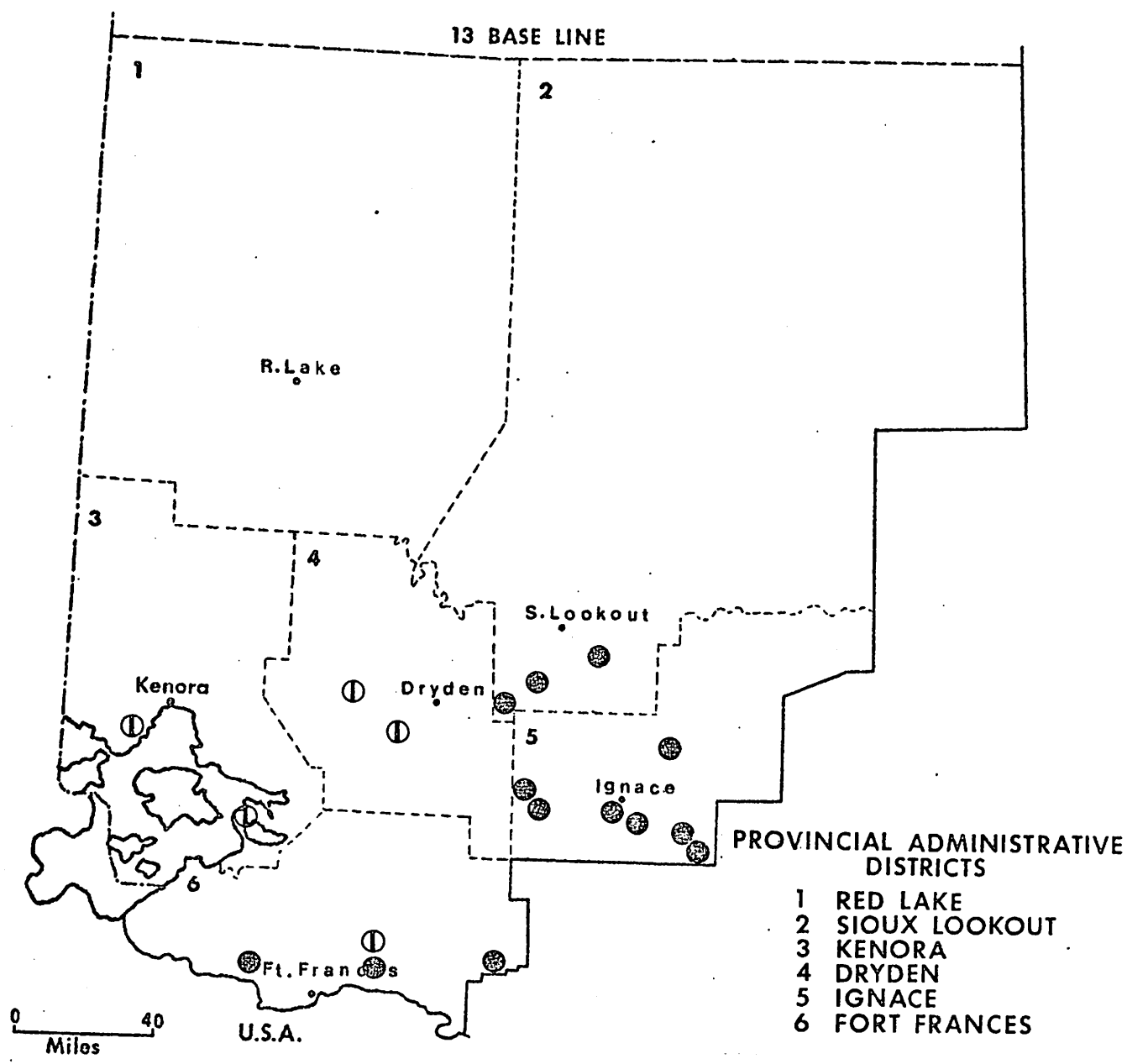


Fig. A1. ASPEN LEAFBLOTCH MINER

Locations at which browning of trembling aspen foliage occurred in 1976

Moderate-to-heavy ●

Light ①

NORTHWESTERN REGION

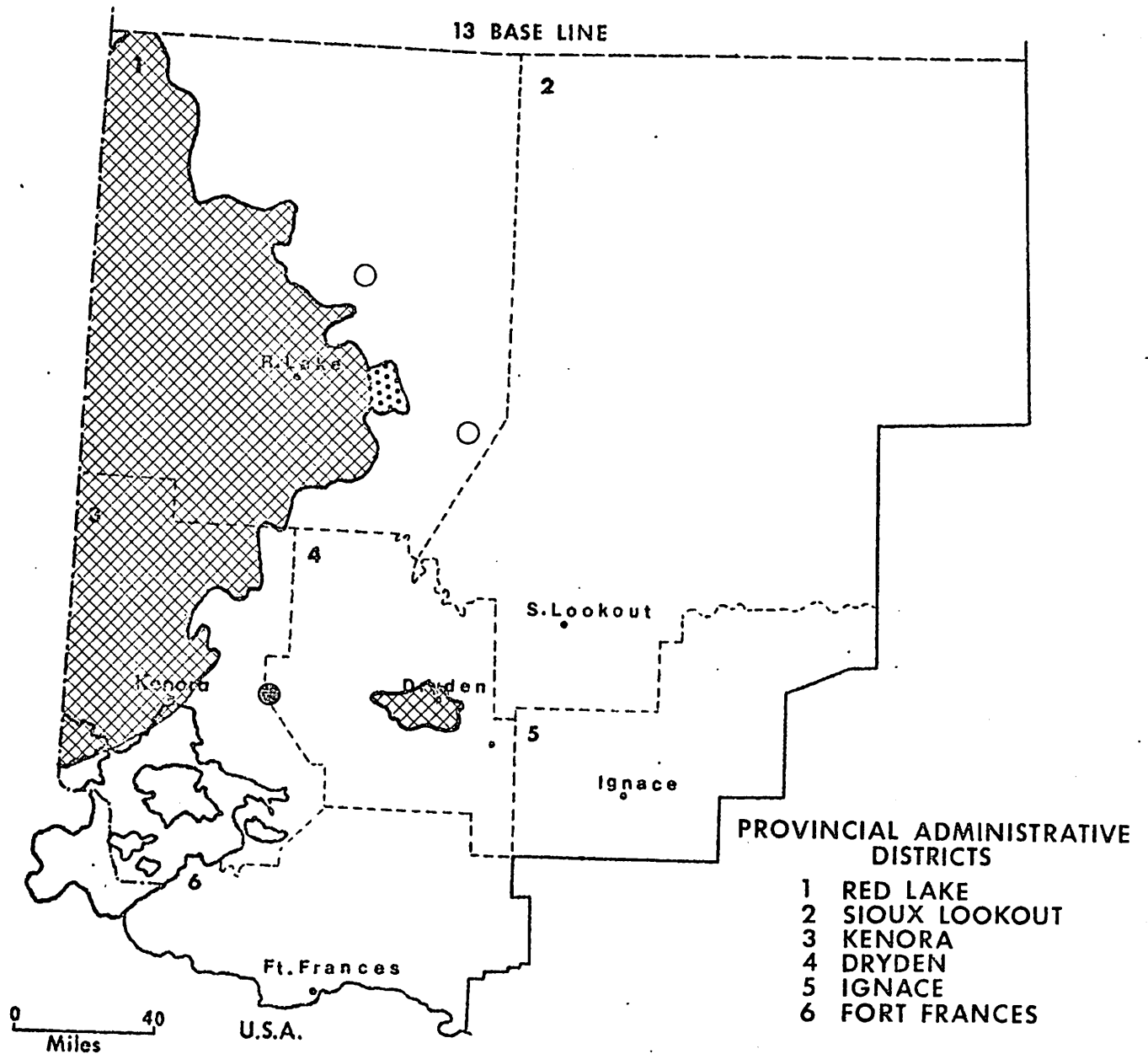






Fig. A2. FOREST TENT CATERPILLAR

Areas within which defoliation of aspen occurred in 1976

Moderate-to-severe . . .  or 
Light  or 

NORTHWESTERN REGION

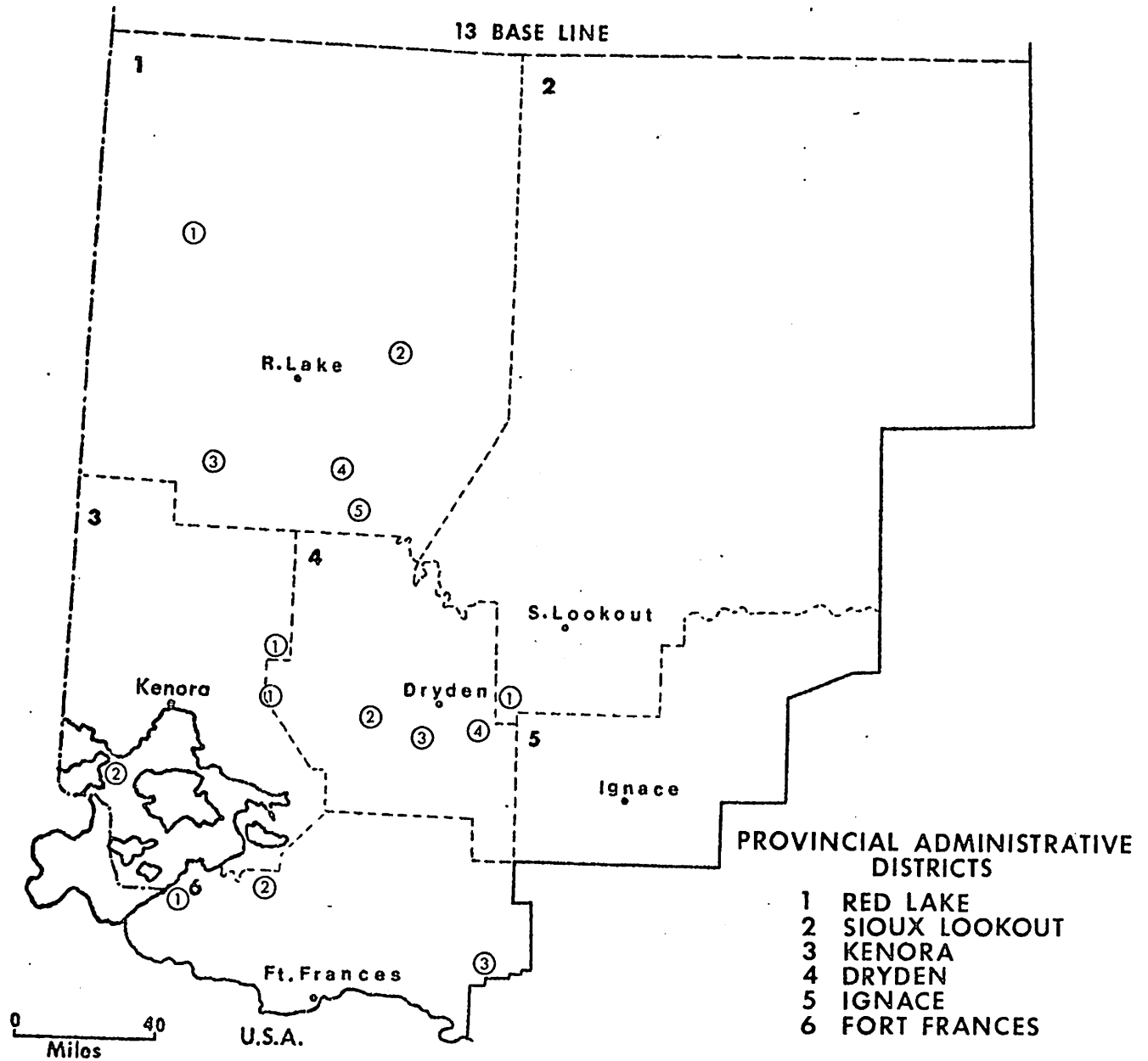


Fig. A3. FOREST TENT CATERPILLAR

Numbered circles show location of egg-band counts in each district

NORTHWESTERN REGION

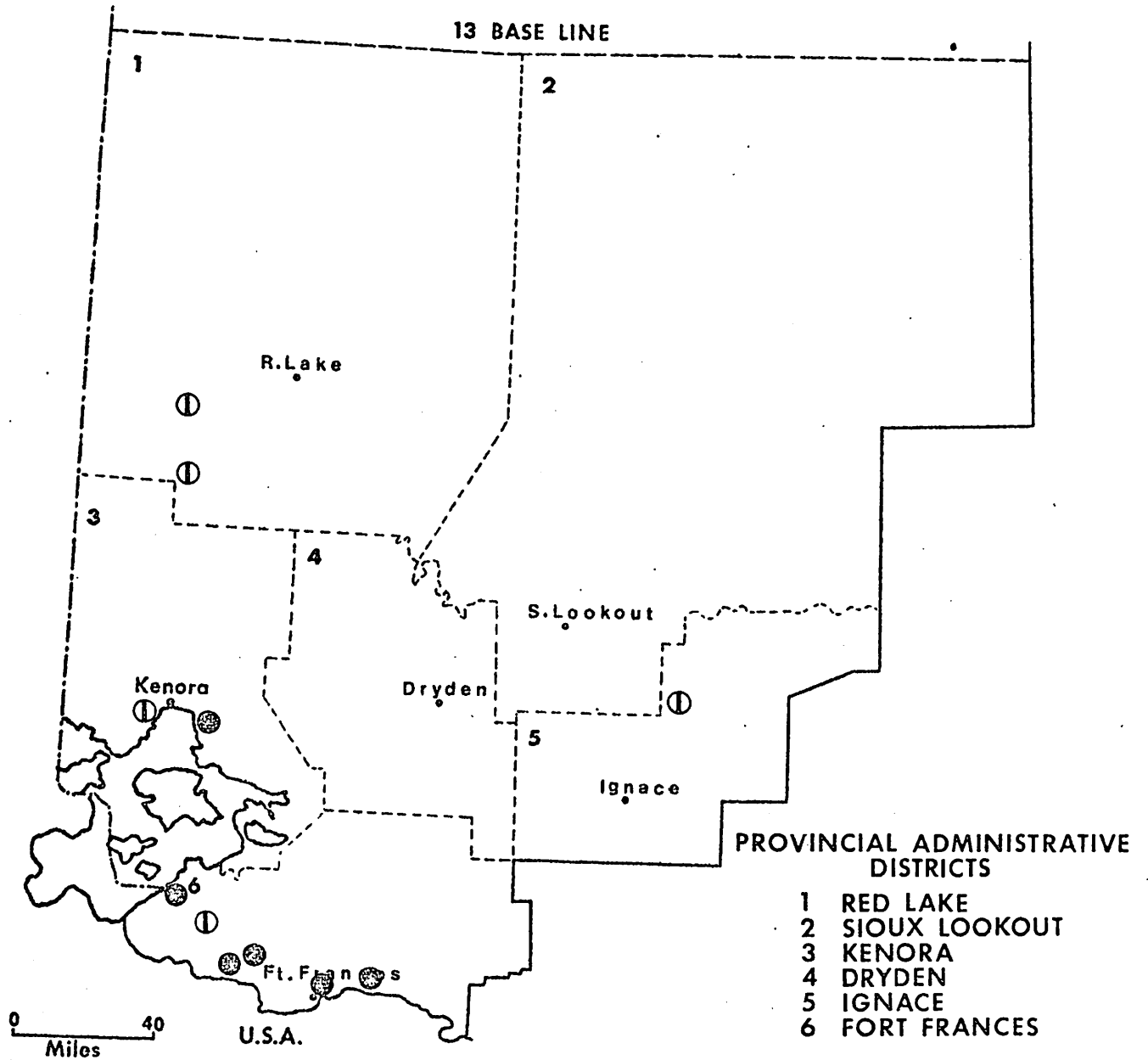


Fig. A4. YELLOW-HEADED SPRUCE SAWFLY

Locations at which defoliation of spruce occurred in 1976

Moderate-to-heavy

Light

NORTHWESTERN REGION

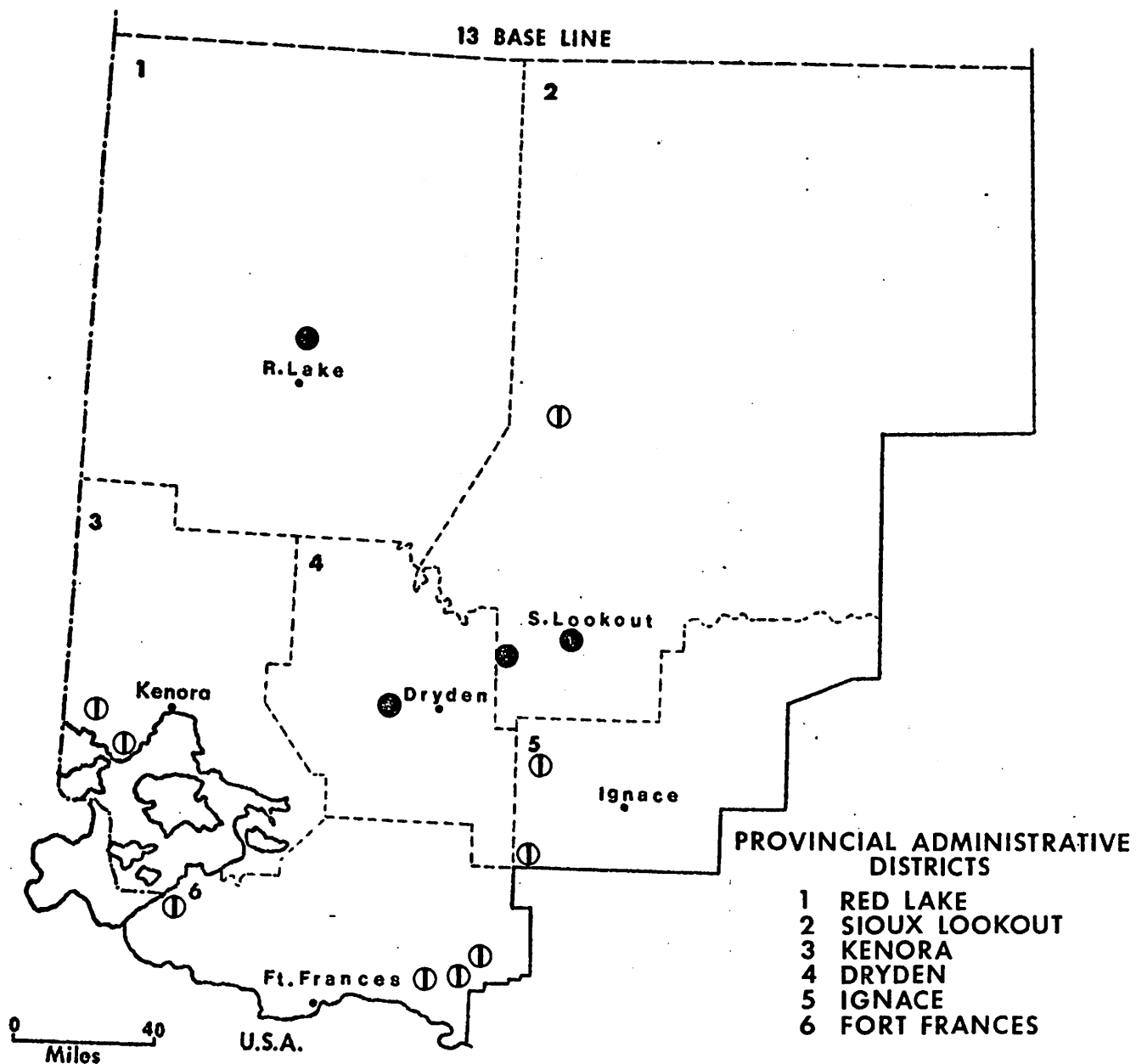


Fig. A5. WESTERN GALL RUST OF HARD PINES

Locations where damage to stems or branches of jack pine were recorded in 1976

Moderate-to-heavy ●

Light ①

NORTHWESTERN REGION

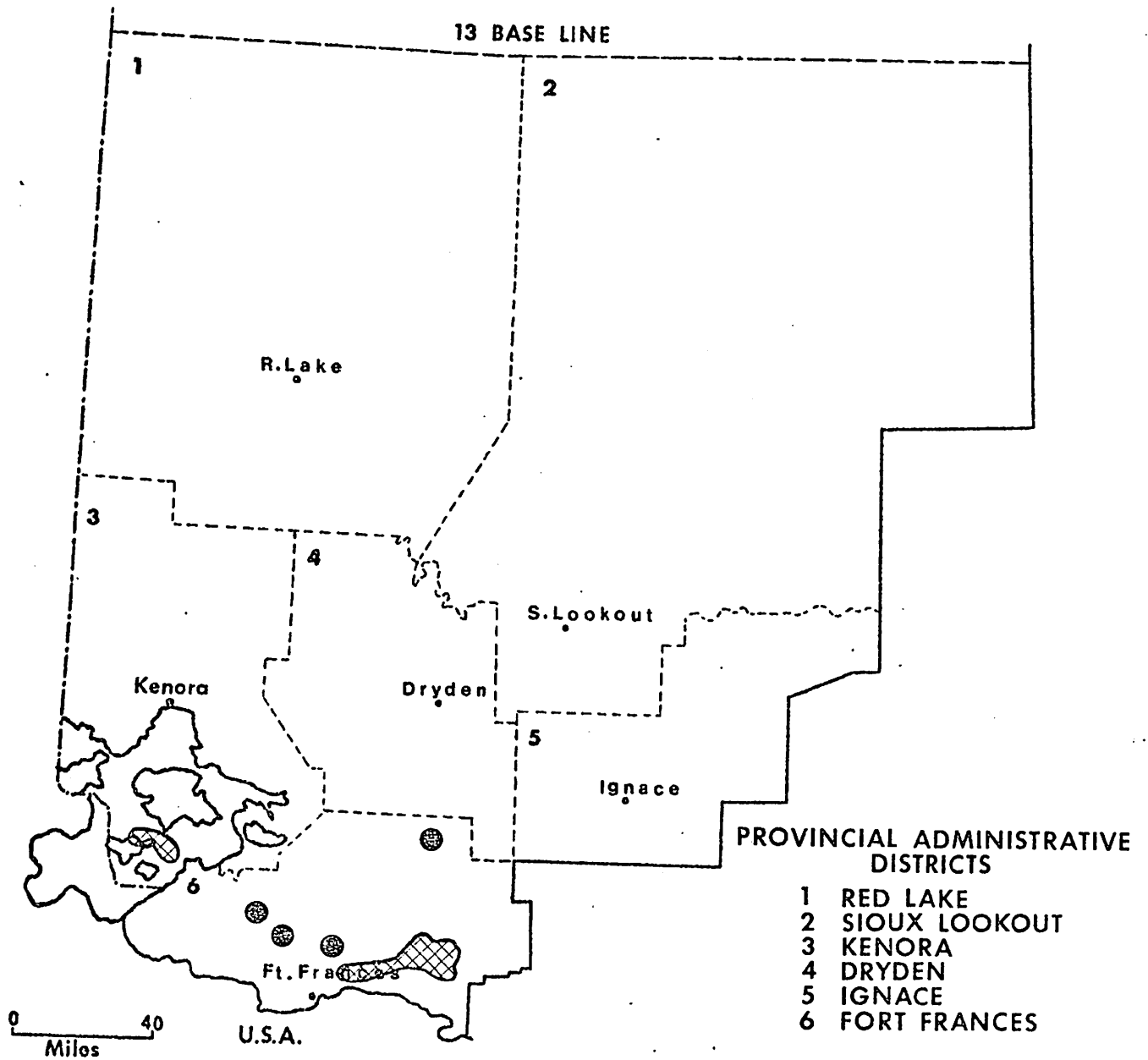


Fig. A6. DROUGHT DAMAGE

Areas where mortality of pine is occurring due to drought

