WINDTHROW PROBLEM AREAS IN PERIPHERAL FORESTS OF MOUNT RAINIER NATIONAL PARK

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As areas surrounding national parks are converted to other uses, altered by human manipulation, the parks are themselves increasingly subject to unnatural outside influences. The parks become islands which have variable degrees of integrity or viability depending upon park size, characteristics of the boundary, and surrounding land uses. Park integrity also depends on the object of interest, e.g., elk versus a small herbaceous plant.

No area, park or otherwise, is completely free of unnatural disturbances. Nevertheless, one objective of park managers is to maintain or even recreate as natural an ecosystem as possible. A part of this job is anticipating the effects that activities in lands surrounding the park are going to have on the park proper.

Forest cutting along the boundaries of heavily forested National Parks, such as we have in the Pacific Northwest, can have significant negative impacts. One specific problem which can be expected is accelerated windbreak and windthrow. This report is an analysis of forests within Mount Rainier National Park which may deteriorate if adjacent timberlands are clearcut. The purpose is to identify (1) potential problem sites for discussion with adjacent landowners and (2) sites where capital investments may be risky.

Another very important effect of forest cutting, greatly improved access to previously remote sections of the Park, is not considered here. It is, however, deserving of a very careful analysis as transportation plans on adjacent National Forest lands are firmed up. Forest harvest roads have already altered use (access) patterns at Mount Rainier. The Canadian forest road in Depot Creek, adjacent to the North Cascades National Park, is a prime example of the adverse effects that such roads can have on the integrity of a Park or Wilderness.

METHOD

Ideally an analysis of the boundary forests would be based on on-the-ground examinations but time permited field examinations of only about 30 miles of Park boundary. Consequently, most of the analysis is based on (1) the standard USGS topographic map of Mount Rainier National Park and (2) a few simple principles which have been developed regarding windthrow around clearcuts.

Relationships between windthrow and cutting have been studied in many parts of the mountain west.1/ Despite the variable geography and forest types certain situations are consistently identified as windthrow hazards:

(1) Exposure of a previously closed stand along the stand's windward boundary, e.g., a clearcut boundary which cuts through a mature (100-year-old) or old-growth forest opening the uncut area to the predominantly southwest stormwinds of the Pacific Northwest;

(2) Ridges, lee slopes or ridges, shoulders of mountains or ridges, saddles in ridges, and narrowing valleys are topographic features subject to especially high and accelerated or turbulent winds. Consequently, cutting boundaries placed on these features often result in extensive windthrow in adjacent uncut stands. The turbulent winds in the lee of ridges are an especially serious problem when timber is cut to the windward ridgeline as are the accelerated winds when timber is cut out of saddles or gaps;

(3) Creation of cutting boundaries with sharp changes in direction and, especially, in shapes which funnel or concentrate the storm winds (as with a corner or v-shaped indentation pointed to the northeast) can cause devastating windthrow in the adjacent (leeward) forest; and

(4) Forests on wet or shallow soils are particularly susceptible as are tall, dense stands regardless of age.

Cutting boundaries which combine several of these features, such as one which is on the lee of a ridge and extends through a dense, tall stand growing on wet soils, are going to cause extremely serious windthrow problems in downwind forests. This has, in fact, already occurred in at least one location on the Park boundary between the Mowich and Carbon River roads.

1/ Alexander, Robert R. 1964. Minimizing windthrow around clearcuttings in spruce-fir forests. Forest Sci. 10:130-142, illus.

Gratkowski, H. J. 1956. Windthrow around staggered settings in old-growth Douglas-fir. Forest Sci. 2:60-74, illus.

Ruth, Robert H., and Ray A. Yoder. 1953. Reducing wind damage in the forests of the Oregon Coast Range. U.S. For. Serv. Pac. Northwest For. and Range Exp. Stn., Res. Pap. 7, 30 p., illus.

RESULTS

Areas where critical windthrow problems do exist or can be expected to develop are shown in figure 1; portions of the Park boundary where problem areas were not identified are not shown. It is important to note that this analysis is based on the assumption that the adjacent non-Park forest will be clearcut, which will almost certainly not be the case with at least parts of the adjacent National Forests. Further, critical windthrow problem areas are considered to be sites where windthrow and associated mortality in the forest can be expected to exceed natural levels by at least five times. Rapid deterioration and, in at least some cases, complete loss of the existing forest stand, can be expected in the affected areas.

Most of the problem areas are found along the western and southern boundaries of the Park (figure 1) reflecting the prevailing southwest storm winds. No problem areas could be identified along most of the north boundary and the northern part of the east boundary; this reflects protection from the storm winds and presence of a high, subalpine bounding ridge, respectively.

Along much of the western boundary chronic windthrow and stand deterioration problems can be expected for 0.1 to 0.3 of a mile due to opening of stands to storm winds and sun. Experience in other areas suggests that windthrow will decrease rapidly with distance from the cutting boundary. Gratkowski[1/] found that windthrow diminished by about one-half in each 50-foot increment of distance from the stand edge with little occurring beyond 200 feet except where special topographic or stand conditions existed. Since this was a short-term study I have assumed that over several decades windthrow will penetrate more deeply before the stand edge stabilizes.

The more serious problems are the numerous sites where topography and/or site conditions (especially wet soils) may result in major salients of windthrow and stand deterioration. Most of these are the numbered locations in figure 1. They will be discussed consecutively.

Stands on the wet, alluvial flats along the Carbon River (1 and 1a in figure 1) are prime candidates for windthrow if cutting exposes their western margin and/or accelerates the up-valley storm winds. Damage would progress from west to east. It is not clear how far such damage could extend. The cross-hatched area is a conservative estimate. If serious windthrow develops in area 1 an additional 2-1/2 miles of forest (area 1a) could progressively be affected.

The areas around Tolmie Creek (2) and in the basin between August and Virginia Peaks (3) have already been subject to major windthrow damage (shown in black on figure 1). The clearcut in the southeast corner of Section 16 has several features which have caused and will continue to cause significant losses in Park forests; as laid out it funnels storm winds into the northeast corner of the clearcut (i.e., into the park) with the boundary being on the lee slope of a saddle in a ridge (which was cutover) and in wet soils as well! About 3/4

mile of the boundary trail has already been buried under down trees and probably twice that amount will eventually be affected. The forest boundary will probably not stabilize until the north slopes above Tolmie Creek are reached.

Most of the August-Virginia Peaks basin will probably be affected before losses stabilize due to its wet soils and progressive direct exposure (as windward trees blowover) to storm winds. It is also located behind the shoulder of the west ridge of Virginia Peak and, therefore, subject to accelerated winds.

The flats and south slope above the lower Mowich River (area 4 in figure 1) are a potential problem area because of wet soils and their position northeast (in the lee) of a major ridge which is being cutover.

Wet soils will probably result in extensive windthrow problem areas below Sunset Park (area 5), along the lower portions of the North and South Forks of the Puyallup River (areas 6 and 7), in the Kenworthy Lake basin (area 8) and along lower Tenas Creek (area 9). The small size of the trees and topographic location may ameliorate the problem in the south half of area 5. Also, it is quite possible that the Forest Service land in Section 9 adjacent to area 8 will not be cut thereby avoiding a stand deterioration problem around Kenworthy Lake.

The seriousness of the windthrow problems along the lower Nisqually River (area 10) are hard to judge which is why it is not cross-hatched. Certainly windthrow has been and remains a major factor in these alluvial forests. Trees are large and shallow rooted in the wet, poorly drained soils which are common. On the other hand, a natural wind-exposed boundary for these stands exists along the Nisqually River so that cutting south of the river will not expose a fresh stand edge. It is not clear whether the effects of cutting would be sufficient to penetrate or destroy the protective river-side stands on the north side of the river. These natural stand borders are at least moderately wind stable and, because of their stepped form, lift winds up and over the leeward forest. If the forest bordering the Nisqually River is once breached serious windthrow losses can be expected in the flats away from the river.

Forests south of Longmire and the Nisqually River (areas 11 and 12) could be quite seriously affected by clearcutting of adjacent lands. The terrace along the river is largely a site with shallow stony soils; southwest storm winds could be funneled directly into a previously protected stand. For 2 miles to the east most of the Park boundary is, unfortunately, located on the lee slope of a major ridge. This ridge and the forests located between the ridge

and Park boundary could be cut in such a way as to cause extensive damage to Park forests. In addition to a lee slope position many of these Park forests are also on relatively wet soils. Finally, the presence of a major knob (point 4907) will further accentuate windthrow problems. The cross-hatched area (11) is a conservative estimate of windthrow problem sites while area 12 may be a more realistic estimate of the eventual stabilized (windfirm) boundaries.

The Park boundaries in area 13 currently run through young-growth (60-to 80-year-old) Douglas-fir forests. The potential windthrow problems here would be several decades off. If adjacent Douglas-fir stands are cutover in 20 to 40 years, tall dense forests within the Park would be exposed to the southwest storm winds.

The 250-year-old stands around the Ohanapecosh entrance (area 14) could be expected to suffer substantial windthrow if exposed along the southern boundary due to southwest storm winds accentuated by the effects of a narrowing valley and, in many locations, shallow soils.

Problems along the Ohanapecosh River-Carlton Creek divide (e.g., area 15) would result from cutting to the ridgetop. Substantial windthrow could be expected on the lee slopes (which are in the Park). This would be accentuated in several locations by wet soils (which are common on north exposures) and local topographic features (saddles and knobs).

DISCUSSION

What is the value of identifying these areas of potential windthrow and accelerated forest stand deterioration since the National Park Service has no direct control over management of the adjacent lands? First, it identifies sites where the Park Service may want to avoid making additional capital investments (e.g., trails or buildings) and, perhaps, take some precautions to protect existing investments (e.g., tree removals around Longmire service area if adjacent National Forest lands are clearcut.)

More importantly, it provides a basis for Park staff to work with adjacent land owners in avoiding or ameliorating adverse affects of actions outside the Park. Having identified critical areas inside the Park appropriate adjustments in land use allocations outside the Park or in techniques (such as layout of cutovers) can be made, especially on adjacent Forest Service lands.

It is by no means necessary to provide a buffer zone of preserved forest all the way around the Park in order to protect Park forests from excessive windthrow. There are numerous ways in which cutting can be accomplished which will substantially reduce the risk of windthrow in adjacent Park forests (see all three references in [1/]).

These include progressive strip clearcutting, use of partial cuts to establish windfirm young stands before the old is totally removed, careful attention to shapes of clearcut boundaries and to overall lcoation of clearcuts in relation to topography (e.g., saddles and knobs), and, leaving of buffer stands in some critical locations. The clearcut located in the southwest corner of Section 16, T.6N., R.7E., is probably a good example of the wrong things to do from the standpoint of adjacent Park forests.

In conclusion, it appears that a relatively small percent of the forests in Mount Rainier National Park could be affected by cutting on adjacent lands and consequent exposure to wind and other elements. However, the potentially affected areas include some of the finest valley forests as well as sites which are heavily used by visitors, such as the lower Carbon River and the Longmire areas. Adverse affects inside the Park can be reduced below those projected by land use allocations and by the selection and layout of cutting systems.

Figure 1.--Areas of Mount Rainier National Park where accelerated windthrow and forest stand deterioration can be expected if adjacent areas are clearcut. Cross-hatched areas are probable problem sites and black areas are sites already known to be affected; numbers are referenced to the text.

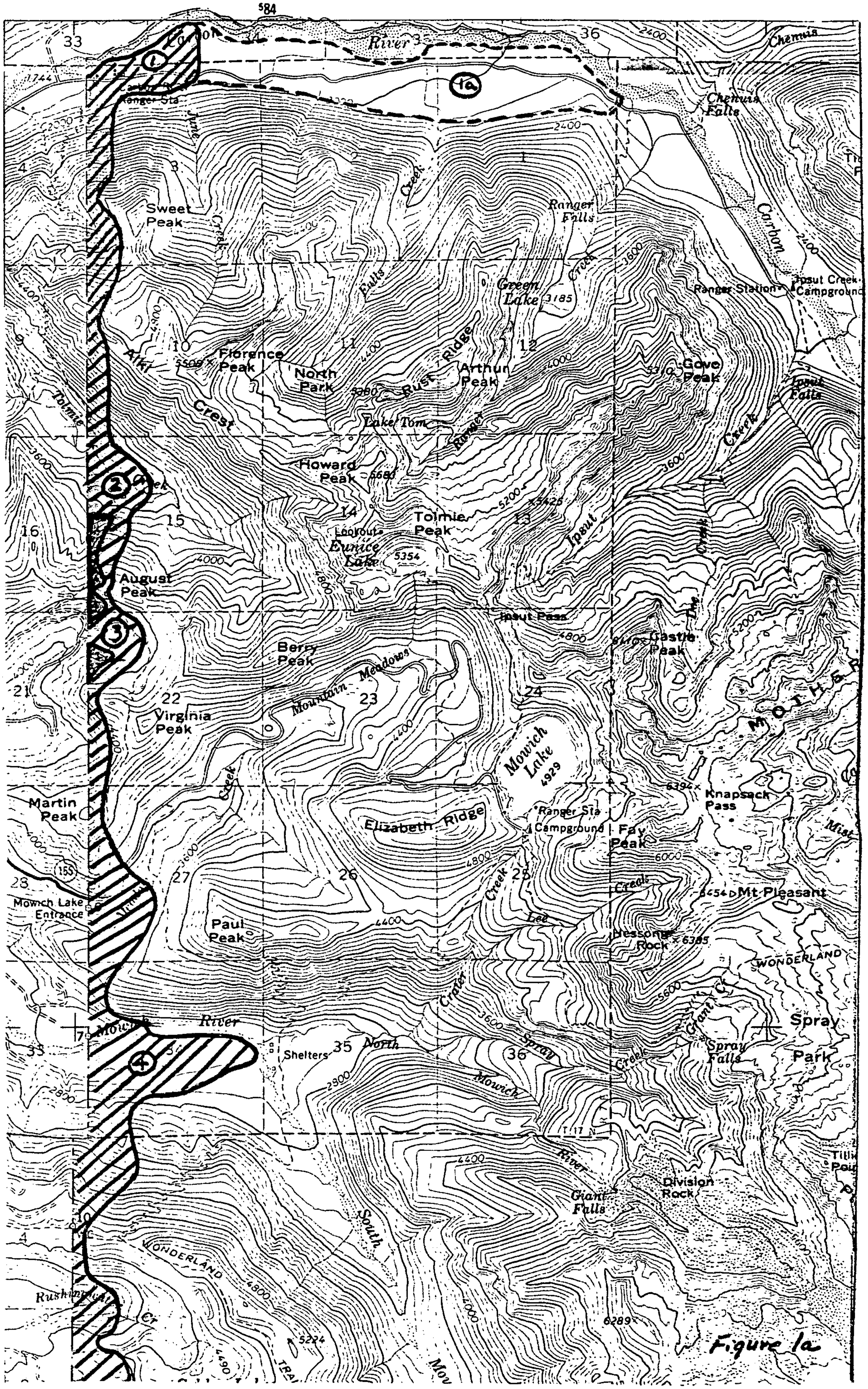
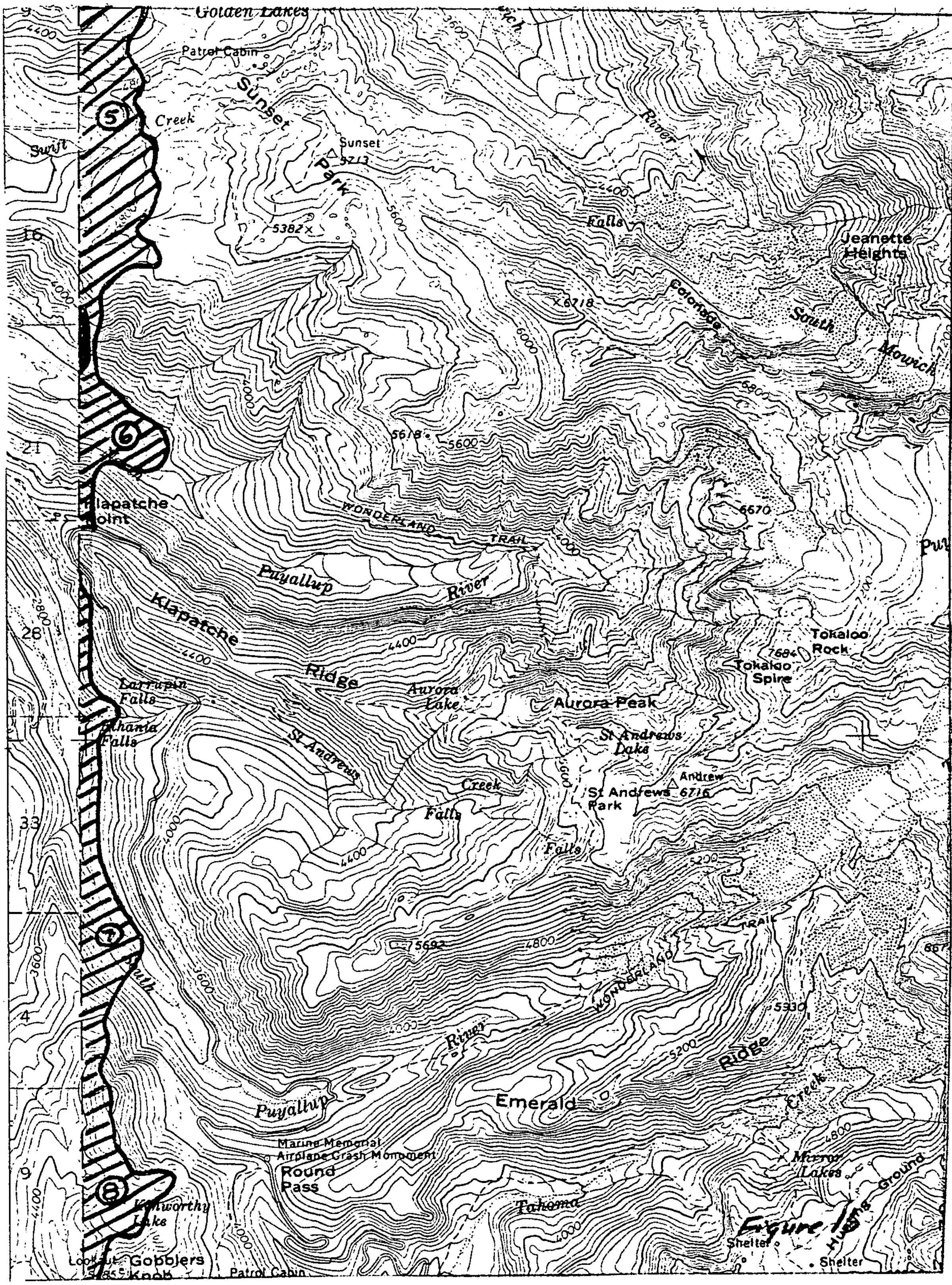
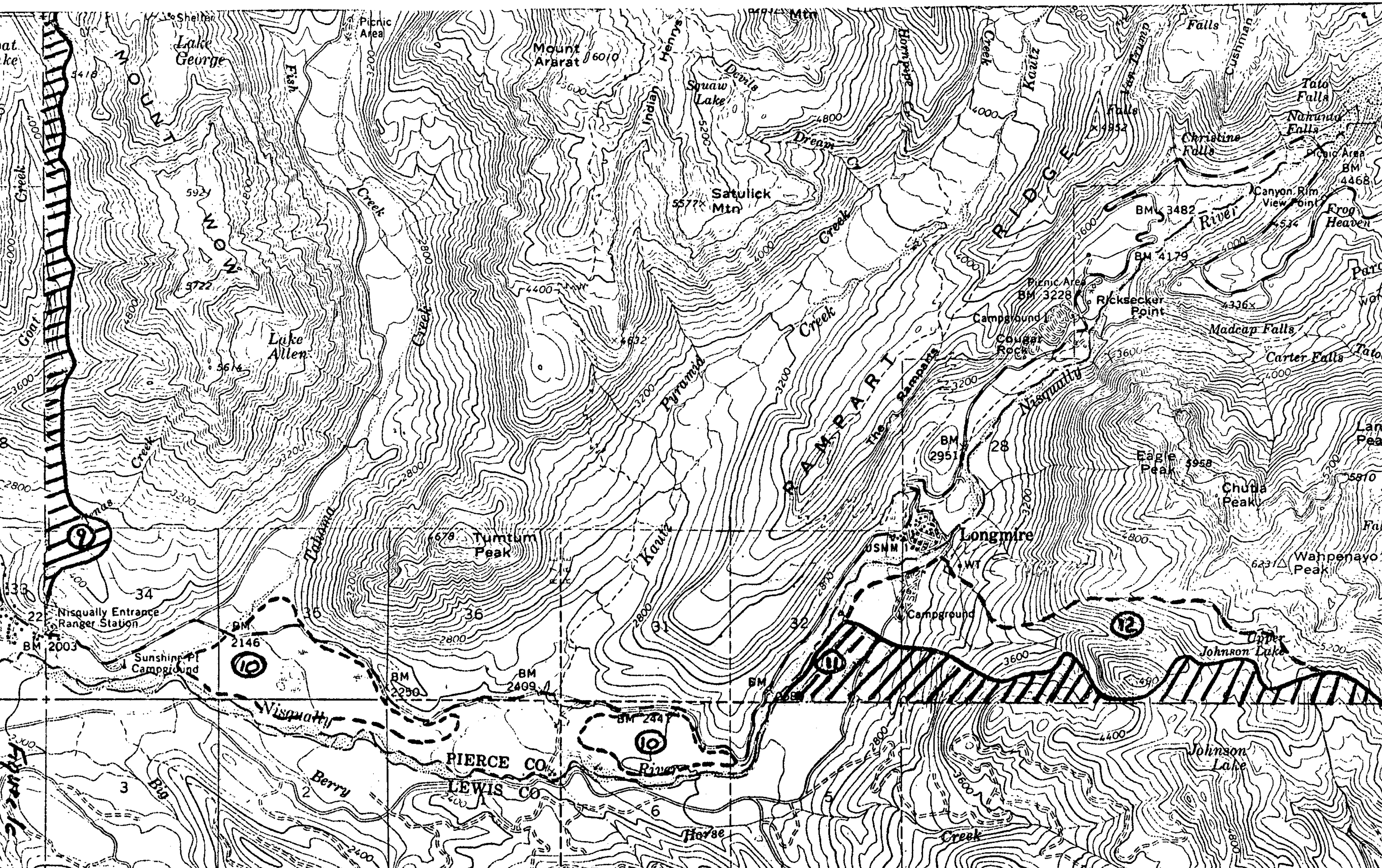

Carbon River
Carbon River Ranger Sta
Chenuis Falls
Sweet Peak
Ranger Falls
Green Lake
Ipsut Creek Ranger Station
Campground
Florence Peak
North Park
Rust Ridge
Arthur Peak
Gove Peak
Ipsut Falls
Alki Crest
Lake Tom
Howard Peak
Tolmie Peak
Lookout
Eunice Lake
August Peak
Ipsut Pass
Castle Peak
Berry Peak
Mountain Meadows
Virginia Peak
Mowich Lake
Martin Peak
Elizabeth Ridge
Ranger Sta
Campground
Fay Peak
Knapsack Pass
Mowich Lake Entrance
Mt Pleasant
Paul Peak
Hessong Rock
WONDERLAND
Mowich River
Shelters
North Mowich River
Spray Creek
Spray Falls
Spray Park
Giant Falls
Division Rock
South
WONDERLAND
Rushingwater Cr

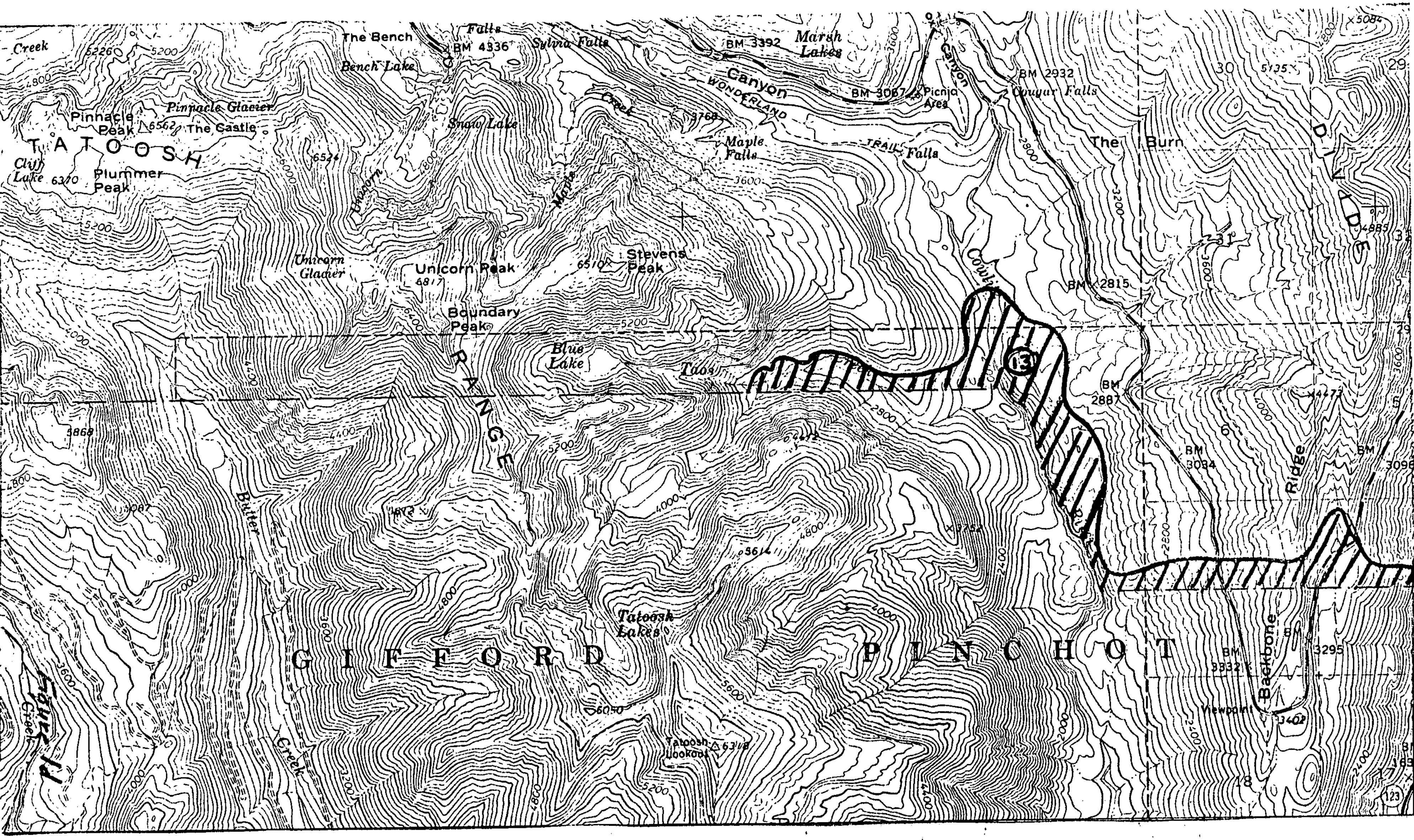
Figure 1a



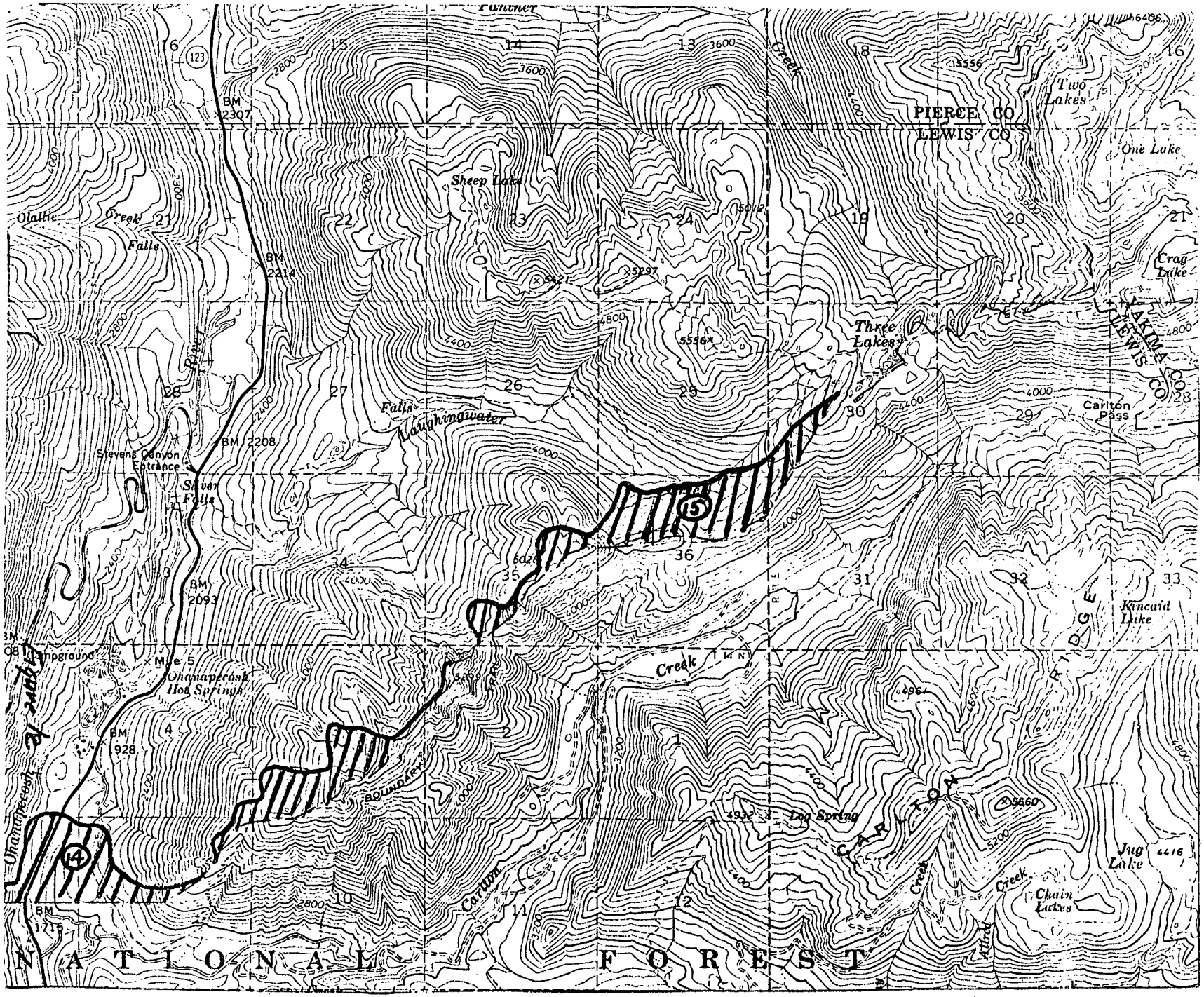
Golden Lakes
Patrol Cabin
Sunset Park
Sunset
5713
Swift
Creek
Jeanette Heights
South Mowich
Klapatche Point
WONDERLAND TRAIL
Puyallup River
Klapatche Ridge
Tokaloo Rock
Tokaloo Spire
Larrupin Falls
Aurora Lake
Aurora Peak
St Andrews Lake
St Andrews Creek
St Andrews Park
Falls
Emerald Ridge
Puyallup
Marine Memorial Airplane Crash Monument
Round Pass
Kilworthy Lake
Gobblers Knob
Tahoma
Mirror Lakes
Shelter
Figure 1b



Lake George
MOUNT WOW
Fish Creek
Picnic Area
Mount Ararat
Indian Henrys
Devils
Squaw Lake
Dream Creek
Kautz Creek
Van Trump Falls
Cushman
Falls
Tato Falls
Nahunta Falls
Christine Falls
Picnic Area
BM 4468
Canyon Rim View Point
Frog Heaven
Satulick Mtn
RIDGE
BM 3482
River
BM 4179
Paradise
Picnic Area
BM 3228
Ricksecker Point
Campground
Cougar Rock
Madcap Falls
Carter Falls
Tatoosh
Lake Allen
Goat Creek
Pyramid Creek
RAMPART
The Ramparts
Nisqually
BM 2951
28
Eagle Peak
Chutla Peak
Lane Peak
Tumtum Peak
Tahoma
Kautz
Longmire
USNM
WT
Wahpenayo Peak
34
Nisqually Entrance Ranger Station
BM 2003
BM 2146
36
31
32
Campground
Sunshine Pt Campground
BM 2250
BM 2409
BM
Upper Johnson Lake
Johnson Lake
Nisqually
River
PIERCE CO
LEWIS CO
Berry
Big
3
2
1
6
5
Horse
Creek



Creek
5226
5200
The Bench
Falls
BM 4336
Sylvia Falls
BM 3392
Marsh Lakes
Bench Lake
Canyon
WONDERLAND
TRAIL
BM 3067
Picnic Area
Canyon
BM 2932
Cougar Falls
30
5135
29
Pinnacle Peak
6562
The Castle
Pinnacle Glacier
TATOOSH
Cliff Lake
6310
Plummer Peak
6524
Snow Lake
Creek
3768
Maple Falls
Falls
The Burn
DIVIDE
Unicorn
Maple
3600
Unicorn Glacier
Unicorn Peak
6817
6510
Stevens Peak
BM 2815
Boundary Peak
5200
Blue Lake
RANGE
13
BM 2887
5868
6
BM 3034
Ridge
BM 3096
Butter Creek
Tatoosh Lakes
GIFFORD PINCHOT
BM 3332
BM 3295
Backbone
Viewpoint
3402
6050
Tatoosh Lookout
6310
18
17
123


Fanover
Creek
PIERCE CO
LEWIS CO
Two Lakes
One Lake
Crag Lake
Sheep Lake
Olallie
Creek
Falls
BM 2307
BM 2214
BM 2208
BM 2093
BM 928
BM 1715
Three Lakes
YAKIMA CO
LEWIS CO
Carlton Pass
Falls
Laughingwater
Stevens Canyon Entrance
Stevens Falls
Campground
Mile 5
Ohanapecosh Hot Springs
Ohanapecosh
Creek
Boundary
Log Spring
CARLTON
RIDGE
Kincaid Lake
Jug Lake
4416
Chain Lakes
Carlton
Creek
NATIONAL FOREST