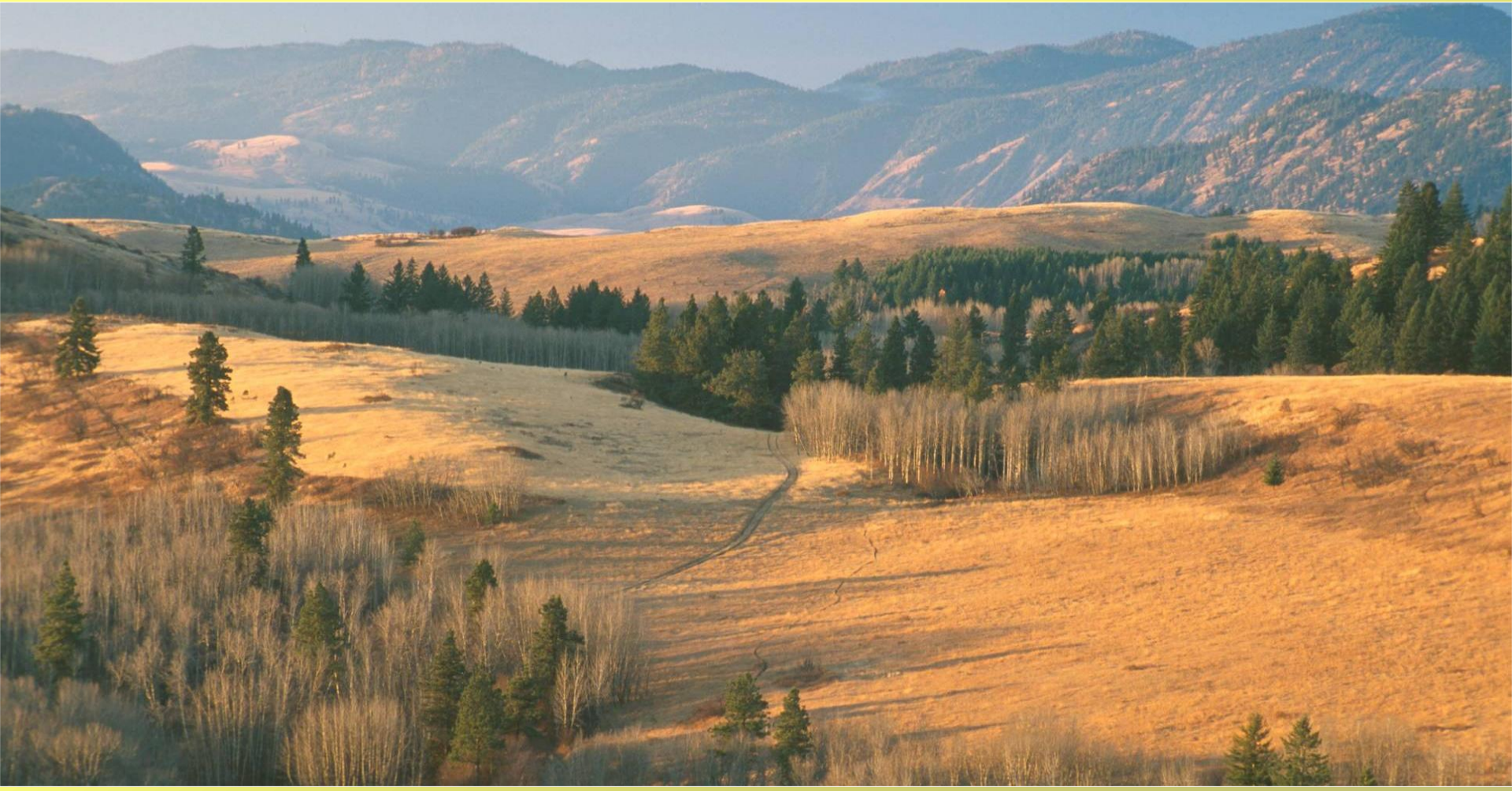
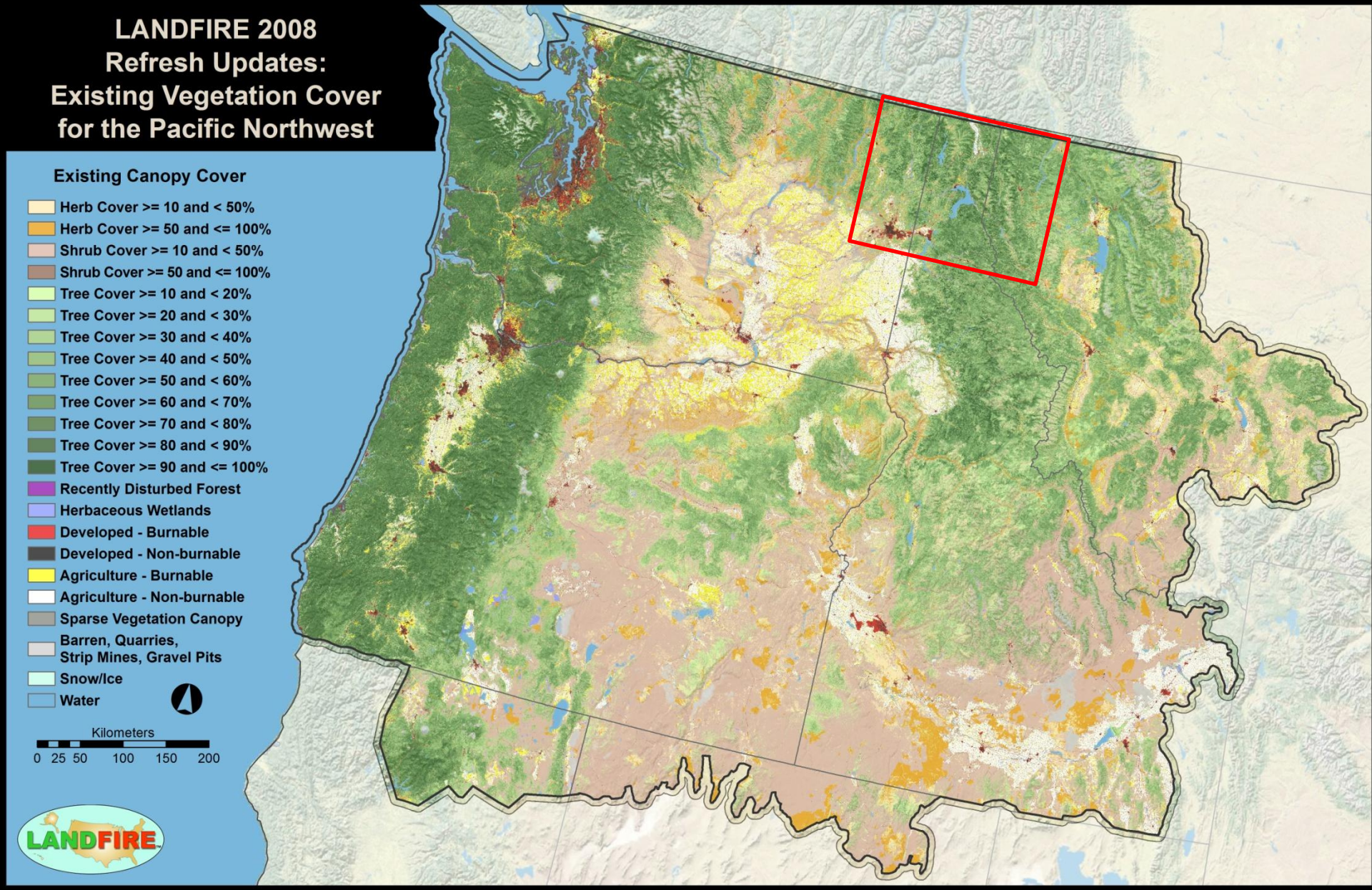
From Stands to Landscapes

Sustaining Ecological and Human Communities

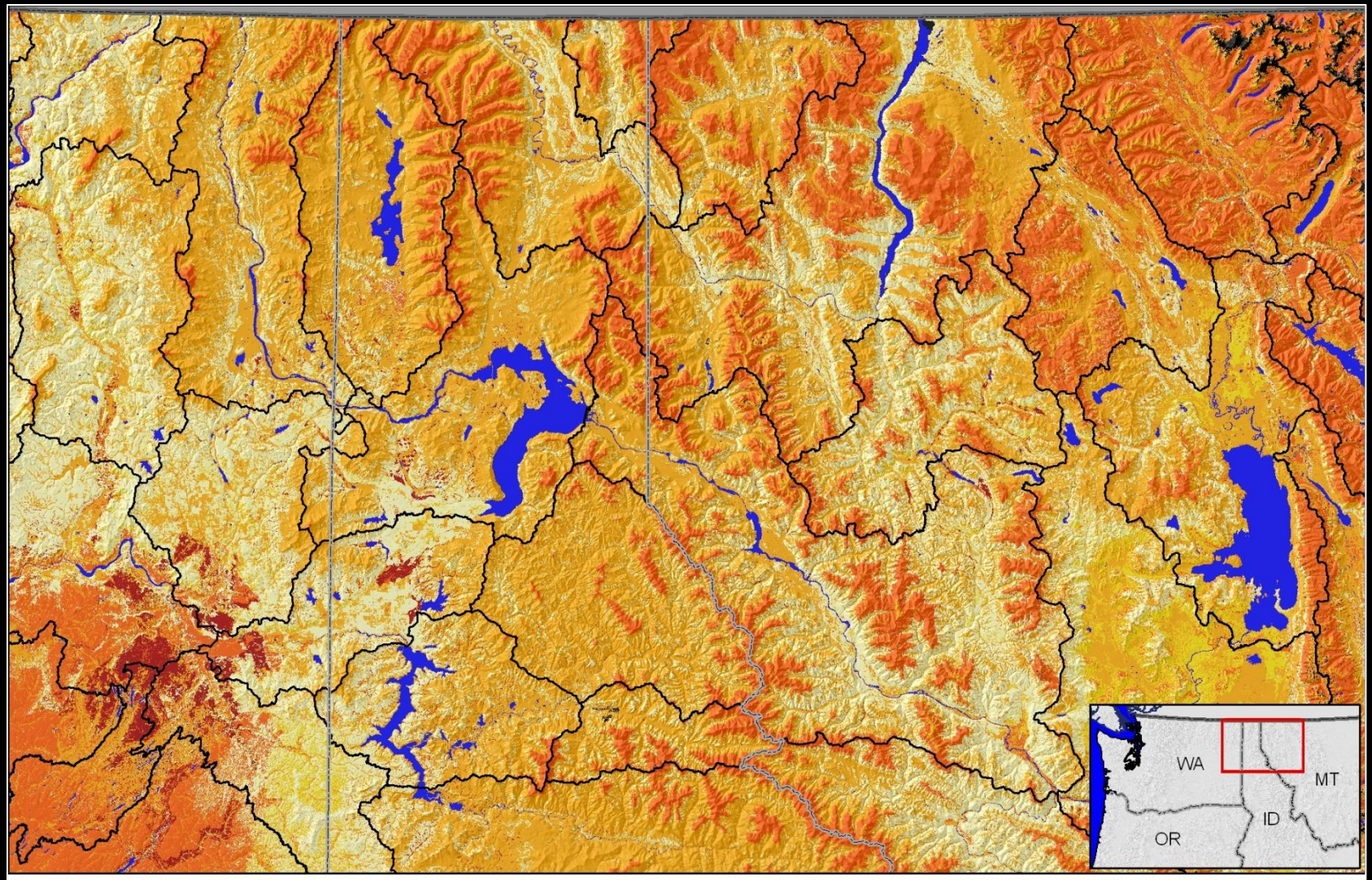


Paul Hessburg, USDA-Forest Service,
PNW Research Station, Wenatchee, WA

LANDFIRE 2008 Refresh Updates: Existing Vegetation Cover for the Pacific Northwest



Historical Fire Regime Groups



Fire Regime Groups

- Fire Regime I (1 to 35 year frequency, low to mixed severity)
- Fire Regime II (1 to 35 year frequency, replacement severity)
- Fire Regime III (35 to 200 year frequency, low to mixed severity)
- Fire Regime IV (35 to 200 year frequency, replacement severity)
- Fire Regime V (200 to 1200 year frequency, any severity)
- water
- rock, barren, ice, and sparsely vegetated

N

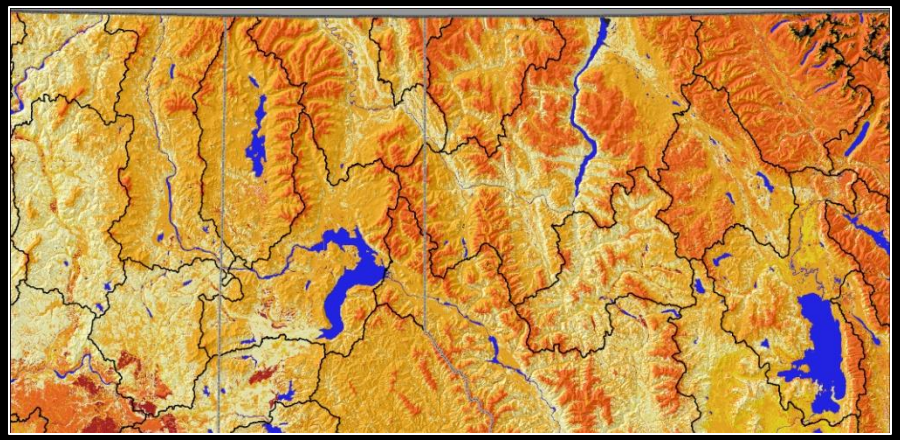
(www.landfire.gov)

0 25 50 Km

Fire Regime group IV

(35-200 yrs btw fires, HSF)

HSF > 70-75% of overstory killed



Major vegetation types:

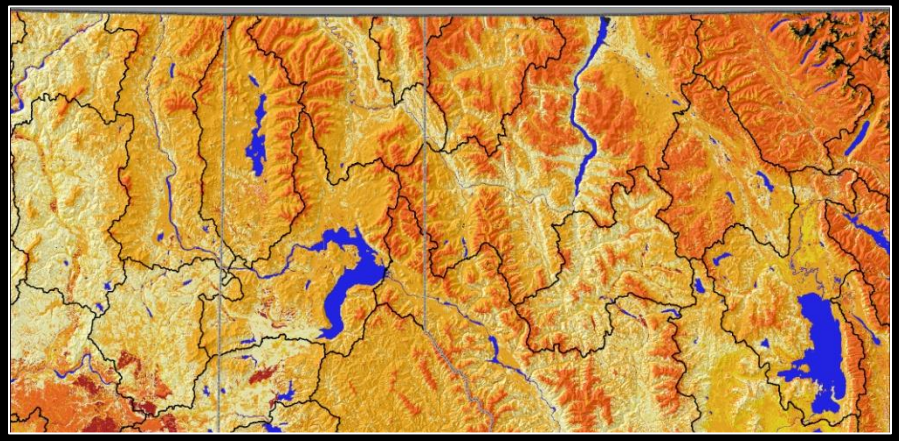
DF-WH, WRC, MH, SAF-ES, LPP

Fire Regime group III

(35-200 yrs btw fires, L+MSF)

MSF, 25-75% of overstory killed

LSF, <25% killed



Major vegetation types:

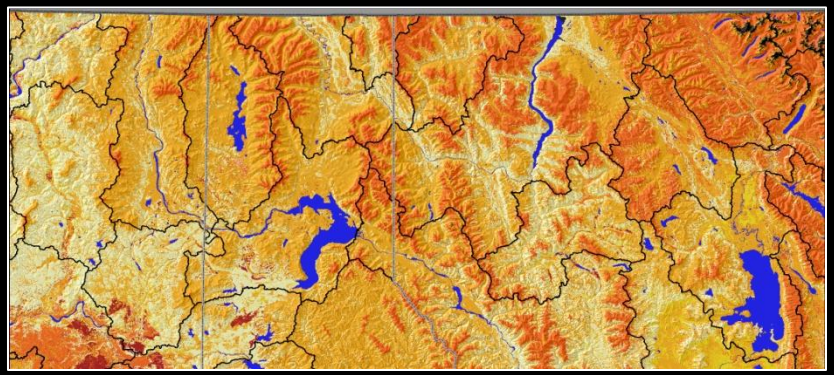
Moist mixed conifer--PP, DF, WL, GF

Fire Regime group I

(0-35 yrs btw fires, L+MSF)

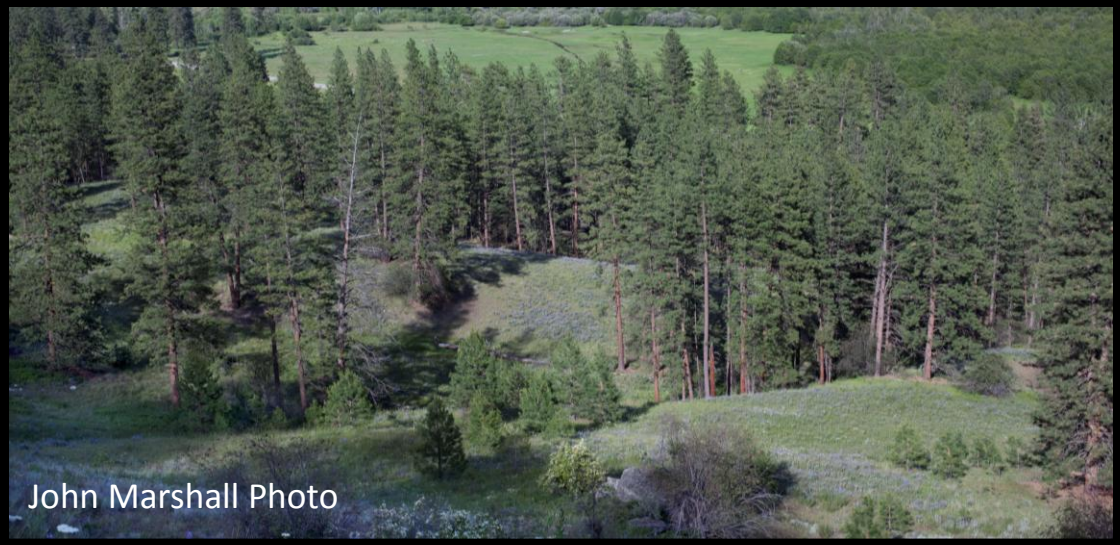
MSF, 25-75% of overstory killed

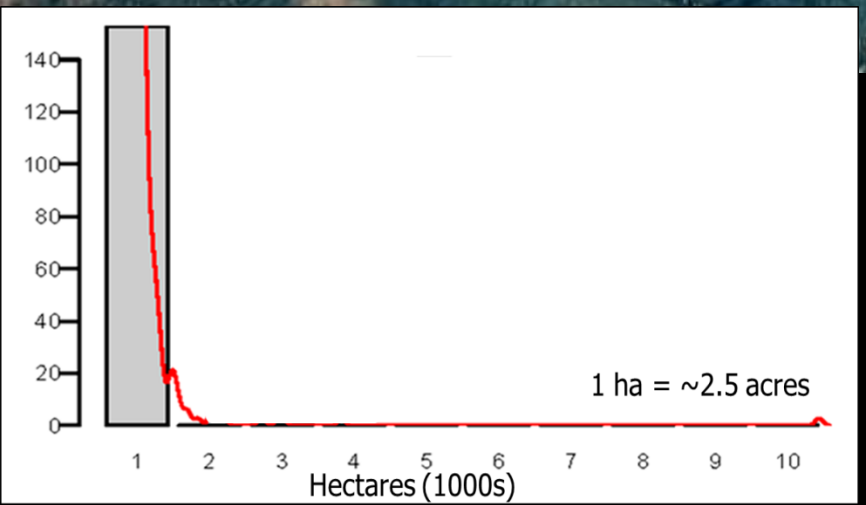
LSF, <25% killed



Major vegetation types:

Dry pine & mixed conifer--PP, DF




140
120
100
80
60
40
20
0
1 ha = ~2.5 acres
1
2
3
4
5
6
7
8
9
10
Hectares (1000s)

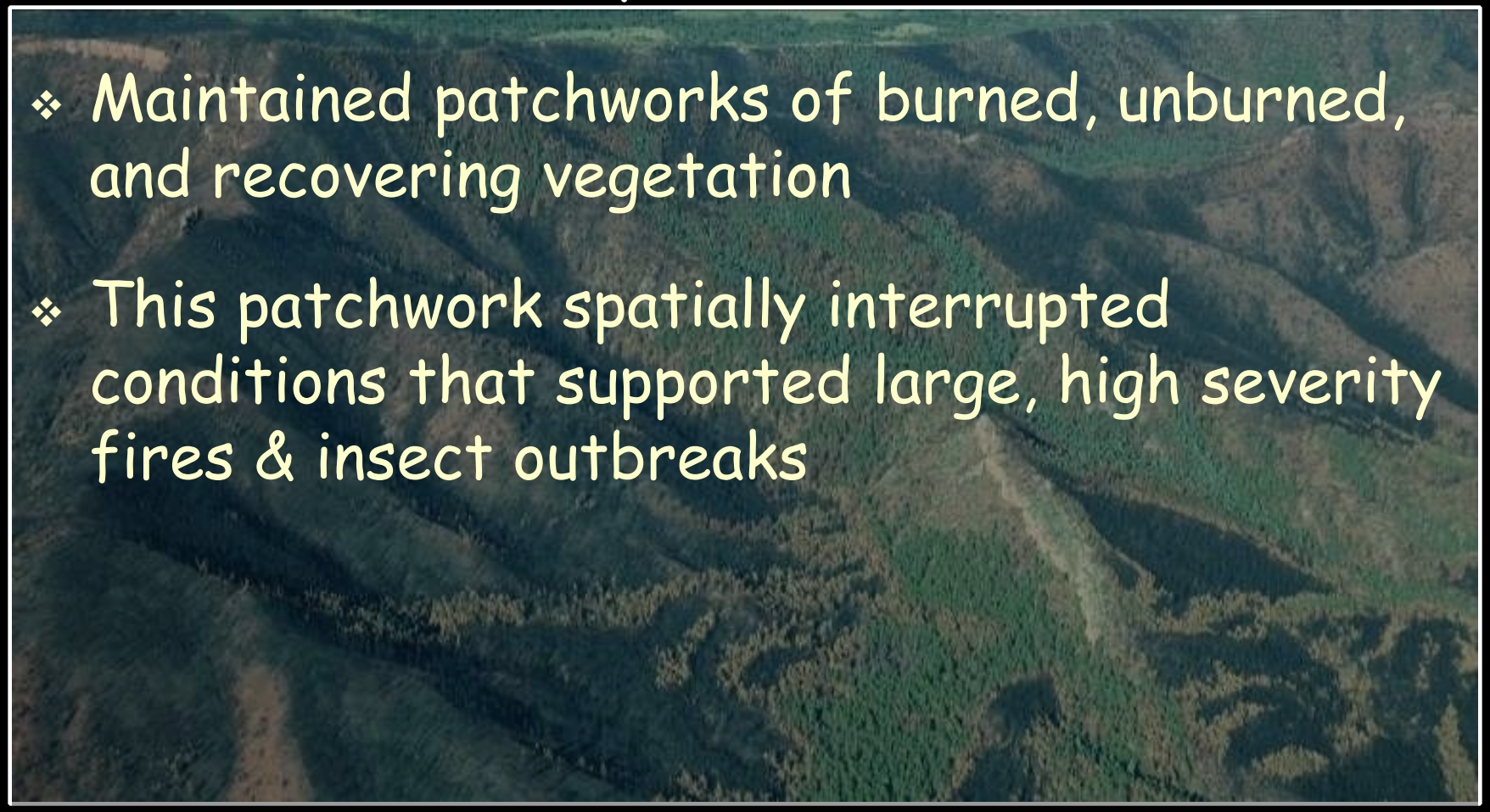
Stand-level feedbacks:

Low and mixed severity fires…

- Reduced surface fuels – frequent L+MSFs reduce duff, litter, fine fuels → shorter FLs, lower FLI, less tree torching
- Increased the height to live crowns – eliminated fuel ladders, elevated crown bases → less torching
- Decreased crown density – reduced crown fuel continuity, heat trapping, crownfire initiation and spread potential
- Favored fire and drought tolerant tree species – PP, WL, DF, increased tree survival, tolerance of frequent L+MSFs
- Favored medium and large sized trees – thick bark reduces mortality
- Favored patchy tree and surface fuel cover – which favored fire tolerant species, low to moderate crown densities

Landscape-level feedbacks too!

Low & mixed severity fires…



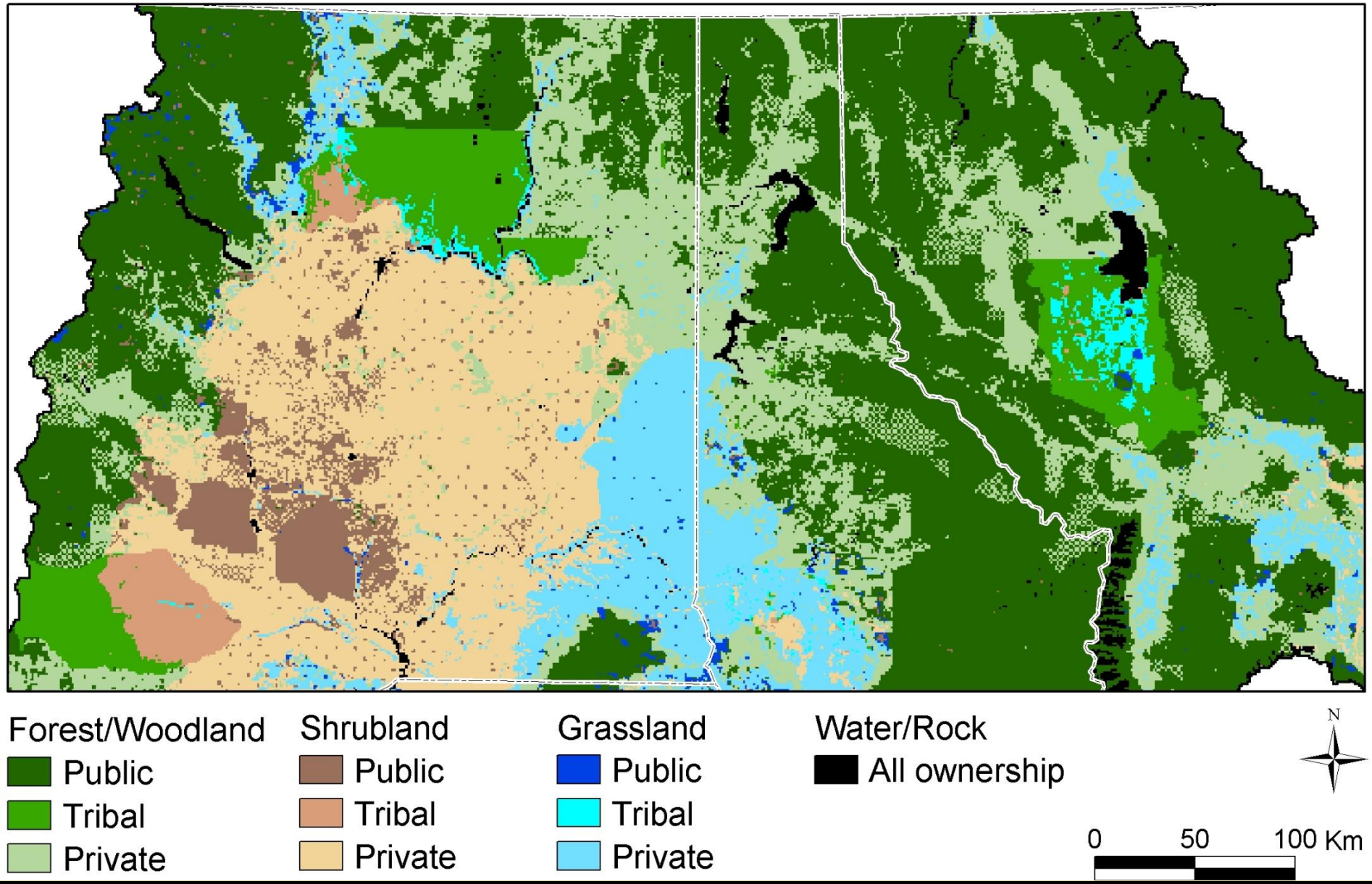
- Maintained patchworks of burned, unburned, and recovering vegetation
- This patchwork spatially interrupted conditions that supported large, high severity fires & insect outbreaks

Change Agents:

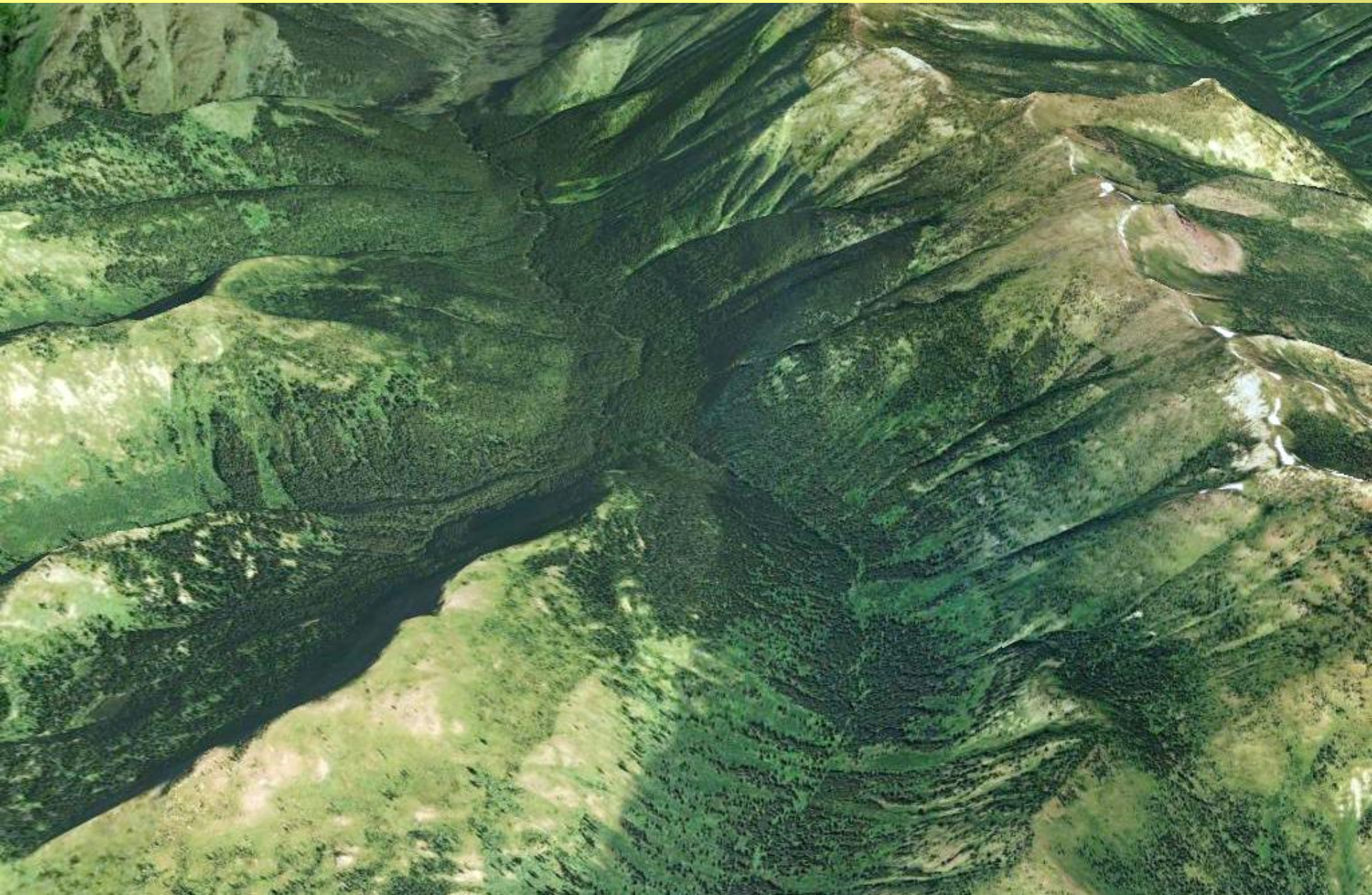
Roads and railroads
Subdividing by ownership
Timber harvest – selection and clear cutting
Domestic livestock grazing
Fire prevention/suppression
Urban/rural development
Agriculture

Key Changes:

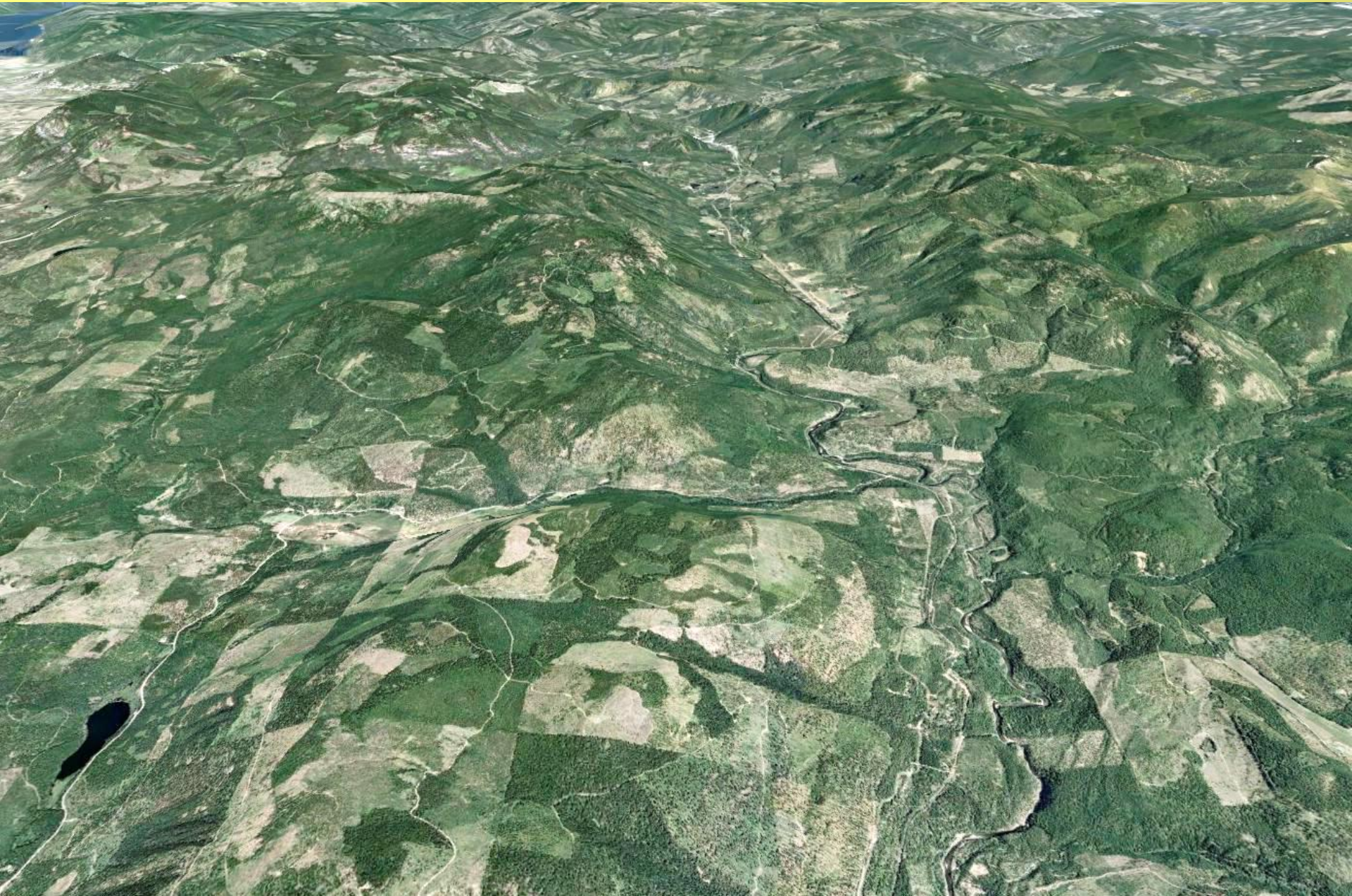
Fragmented forest - more small patches, fewer large
Simpler structure – all age mosaic → young forest
Simpler composition – less WWP, PP, WL; more DF, GF, WH, WRC, SAF
Increased disturbance vulnerability (fires, insect outbreaks)
Fewer grasslands & shrublands

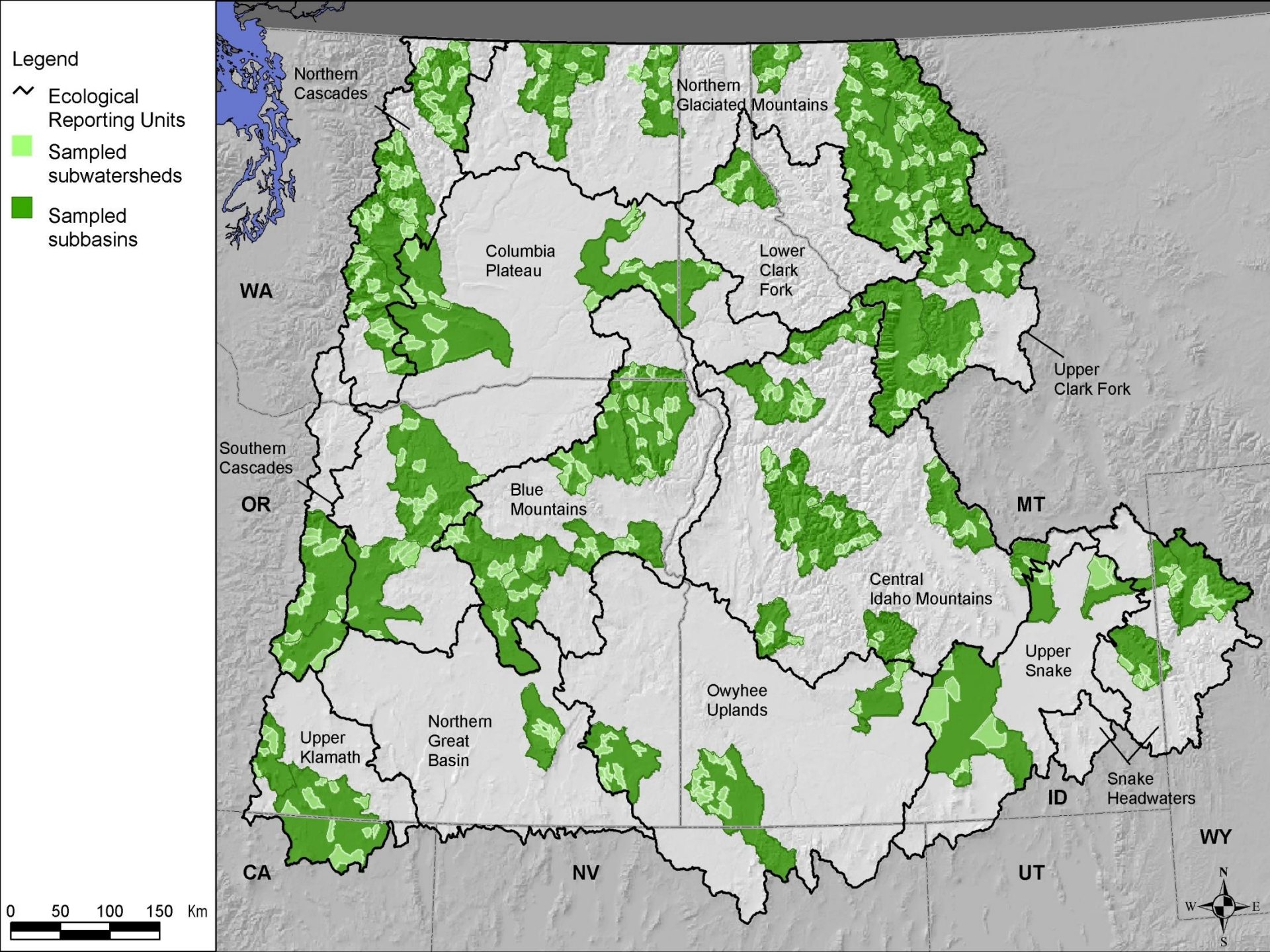

Forest/Woodland
Public
Tribal
Private
Shrubland
Public
Tribal
Private
Grassland
Public
Tribal
Private
Water/Rock
All ownership
N
0
50
100 Km

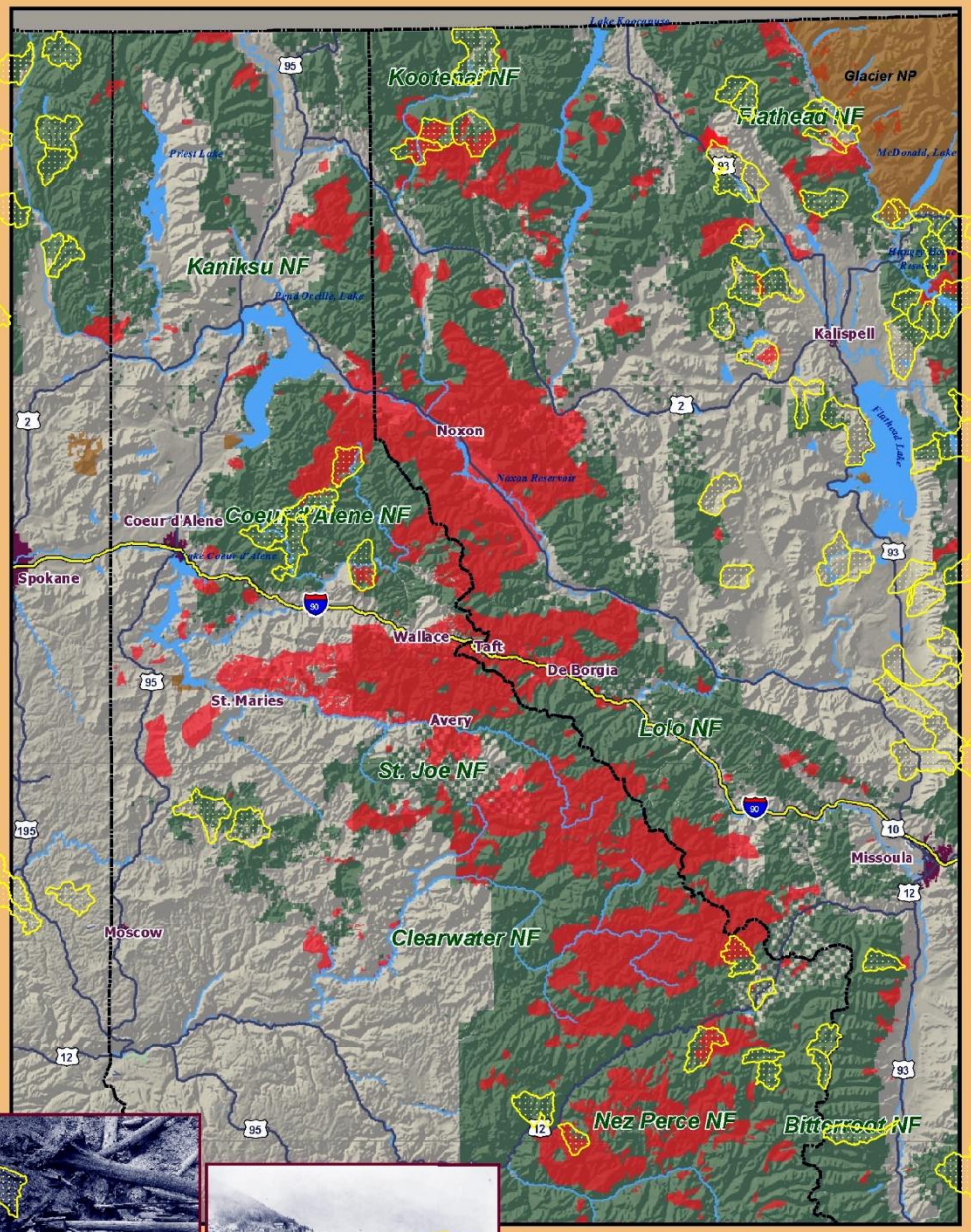
Before Stand Management



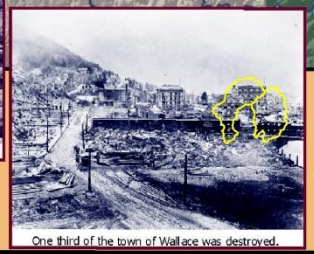
After Stand Management




Legend
Ecological Reporting Units
Sampled subwatersheds
Sampled subbasins
Northern Cascades
Northern Glaciated Mountains
Columbia Plateau
Lower Clark Fork
Upper Clark Fork
WA
Southern Cascades
OR
Blue Mountains
MT
Central Idaho Mountains
Upper Snake
Owyhee Uplands
Northern Great Basin
Upper Klamath
Snake Headwaters
ID
WY
CA
NV
UT
0 50 100 150 Km
N
W
E
S

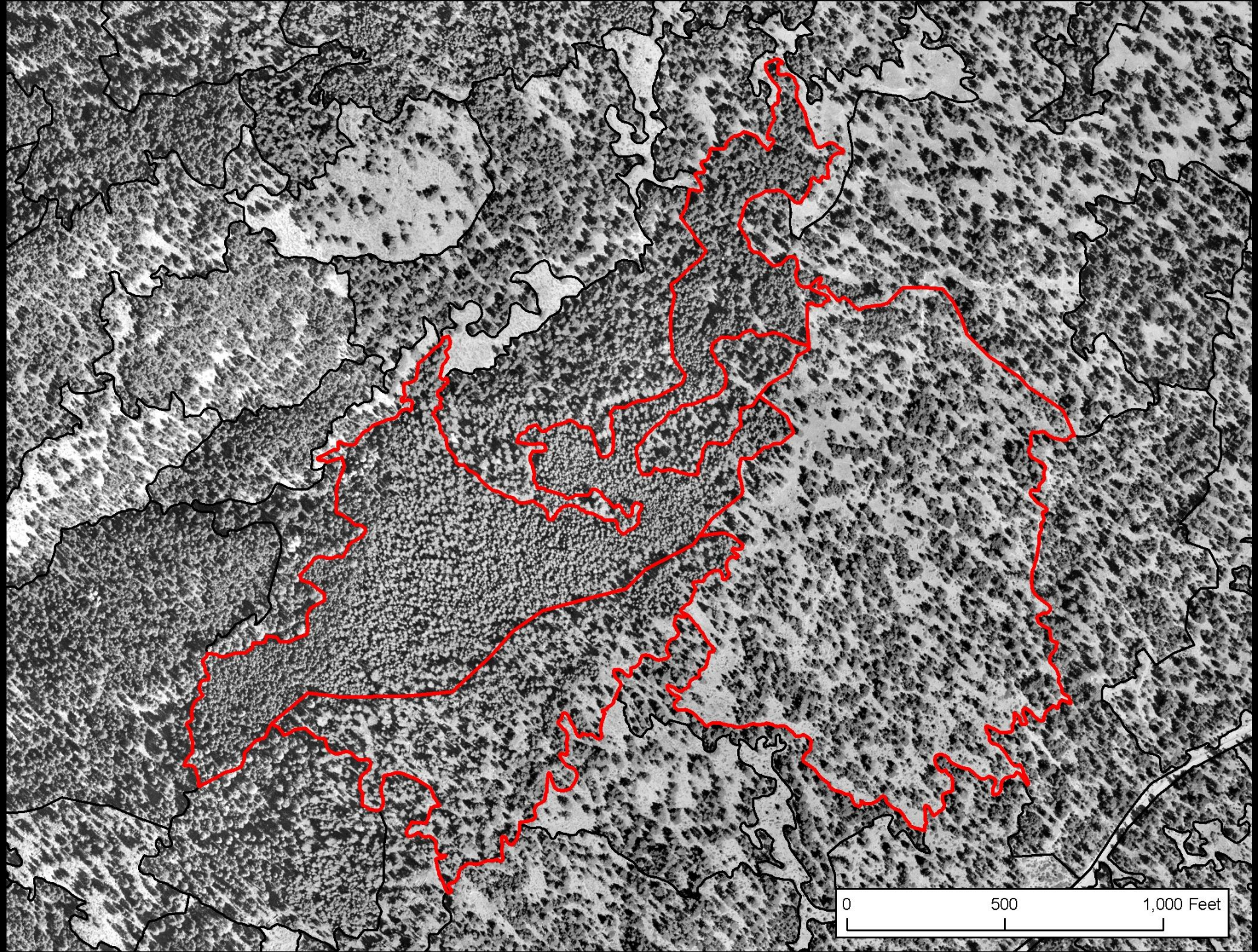


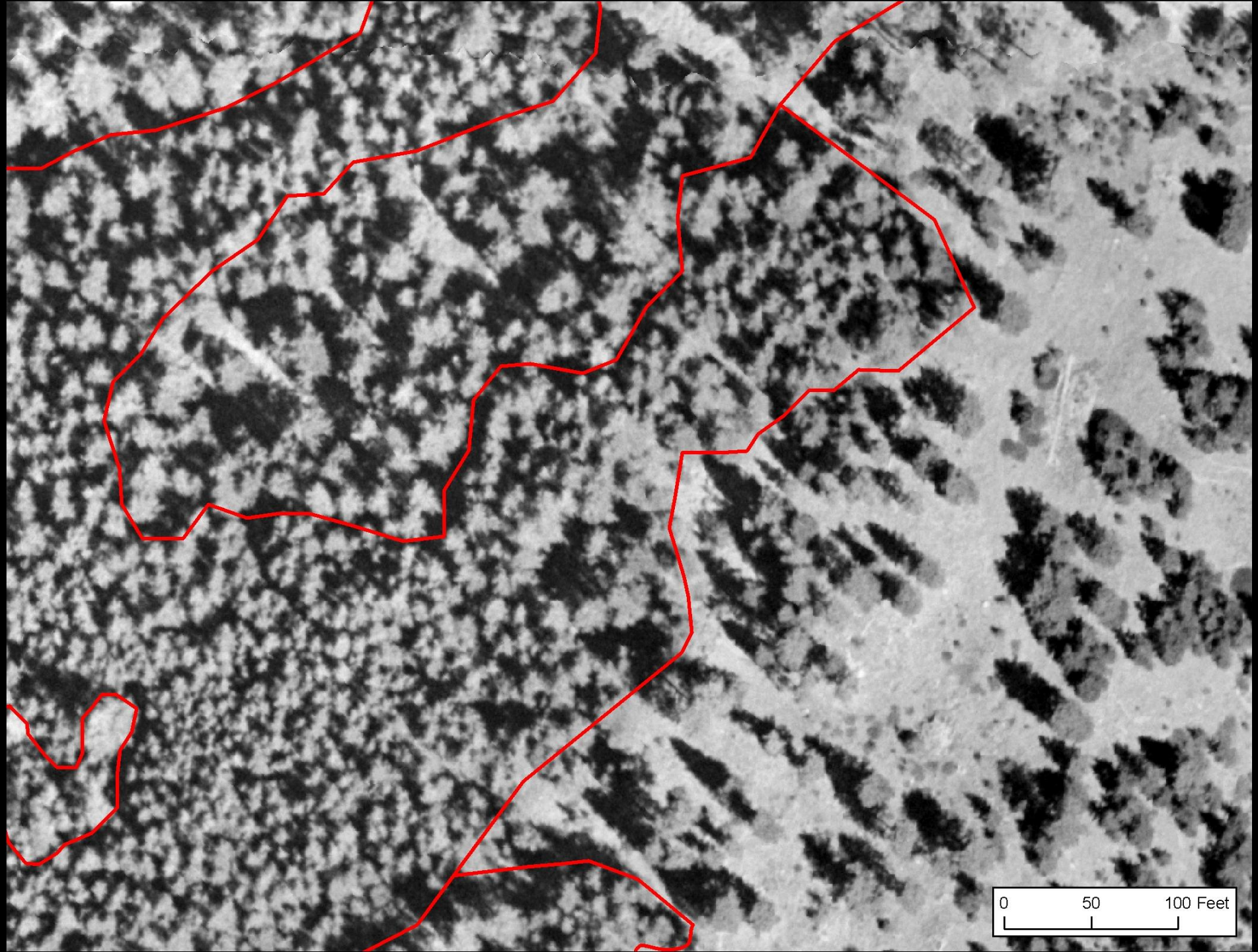
The Pulaski Tunnel after the fire

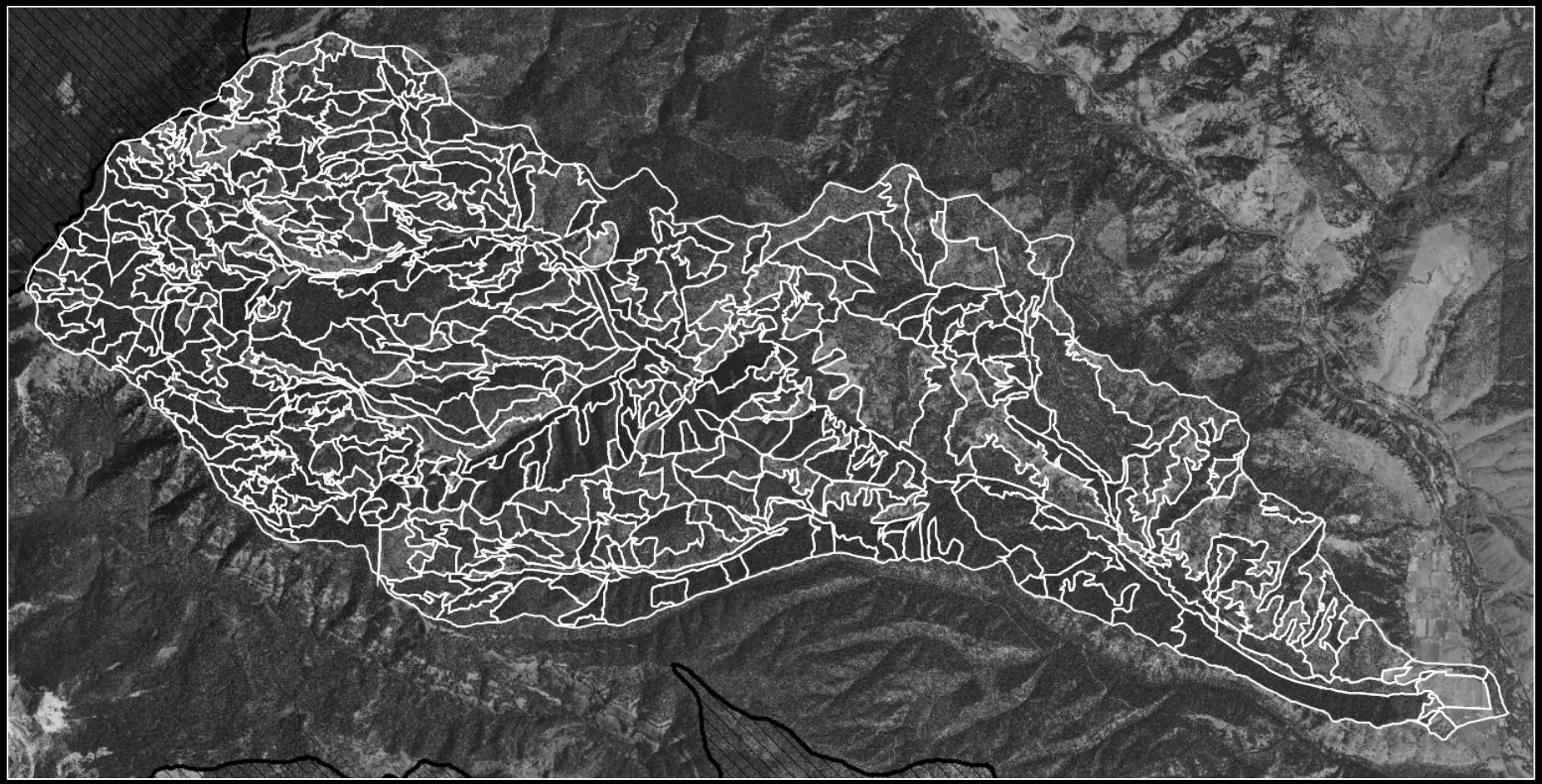

One third of the town of Wallace was destroyed.

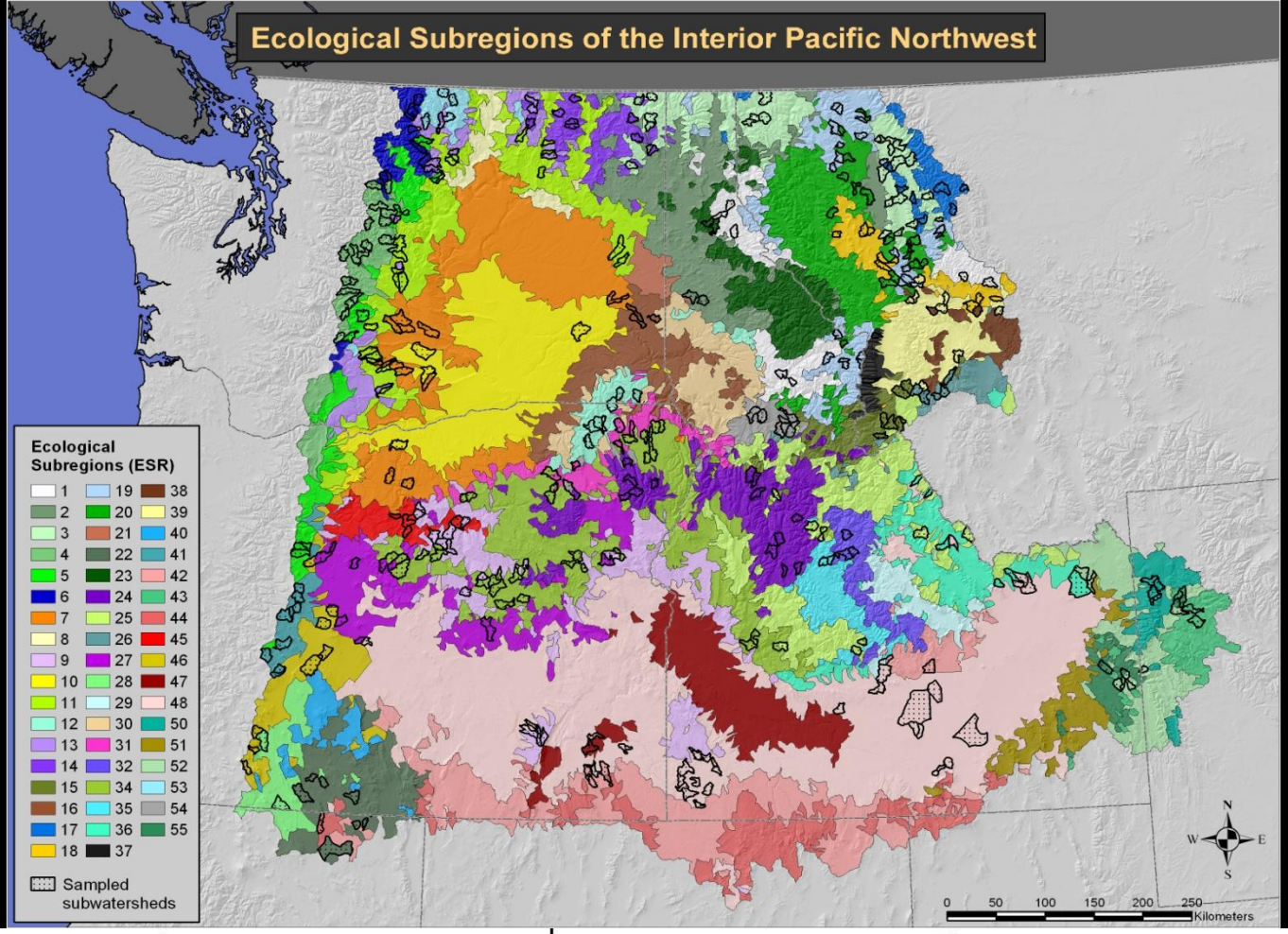
The Great 1910 Fire

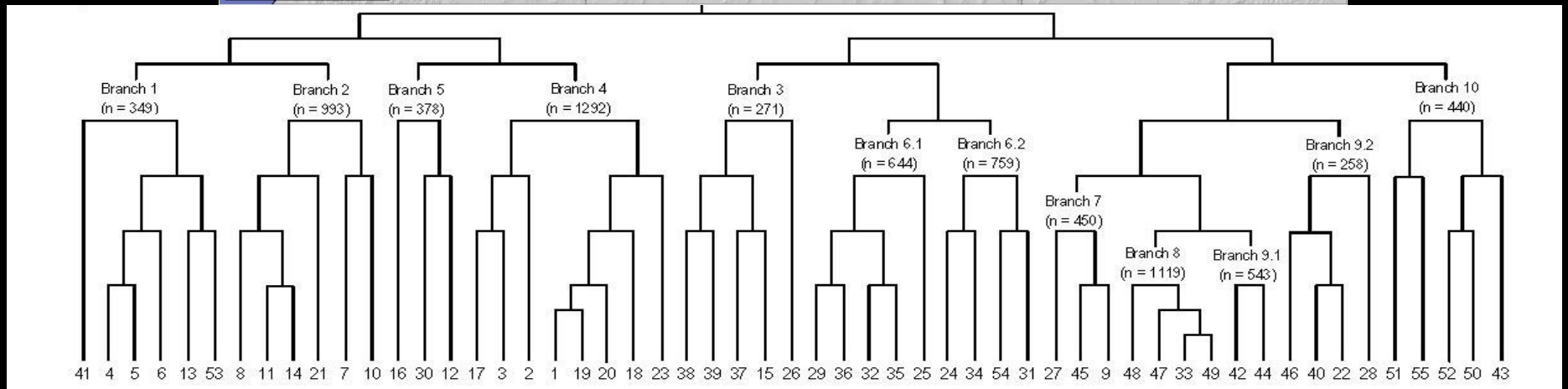
of Idaho & Montana

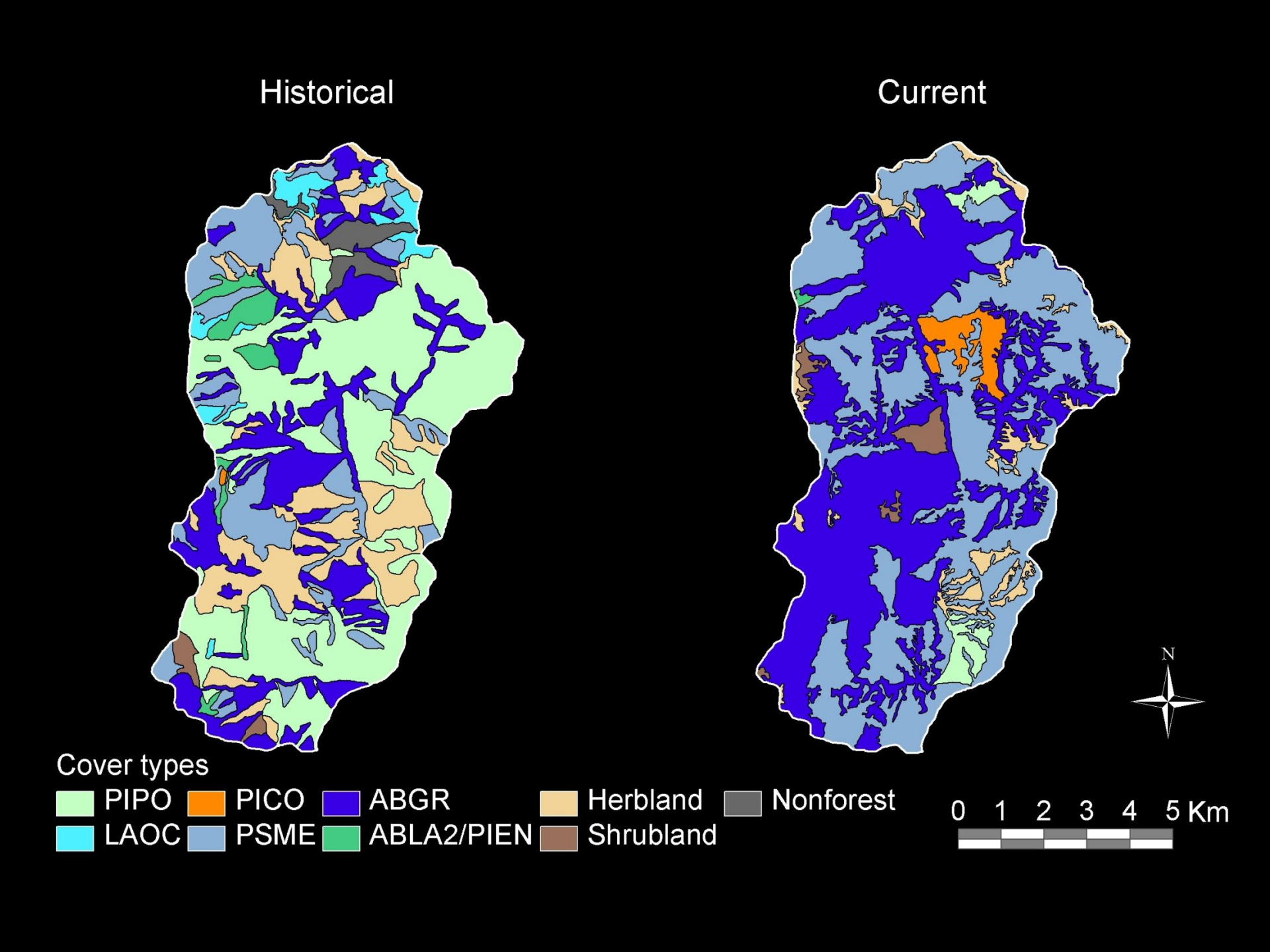

0
500
1,000 Feet

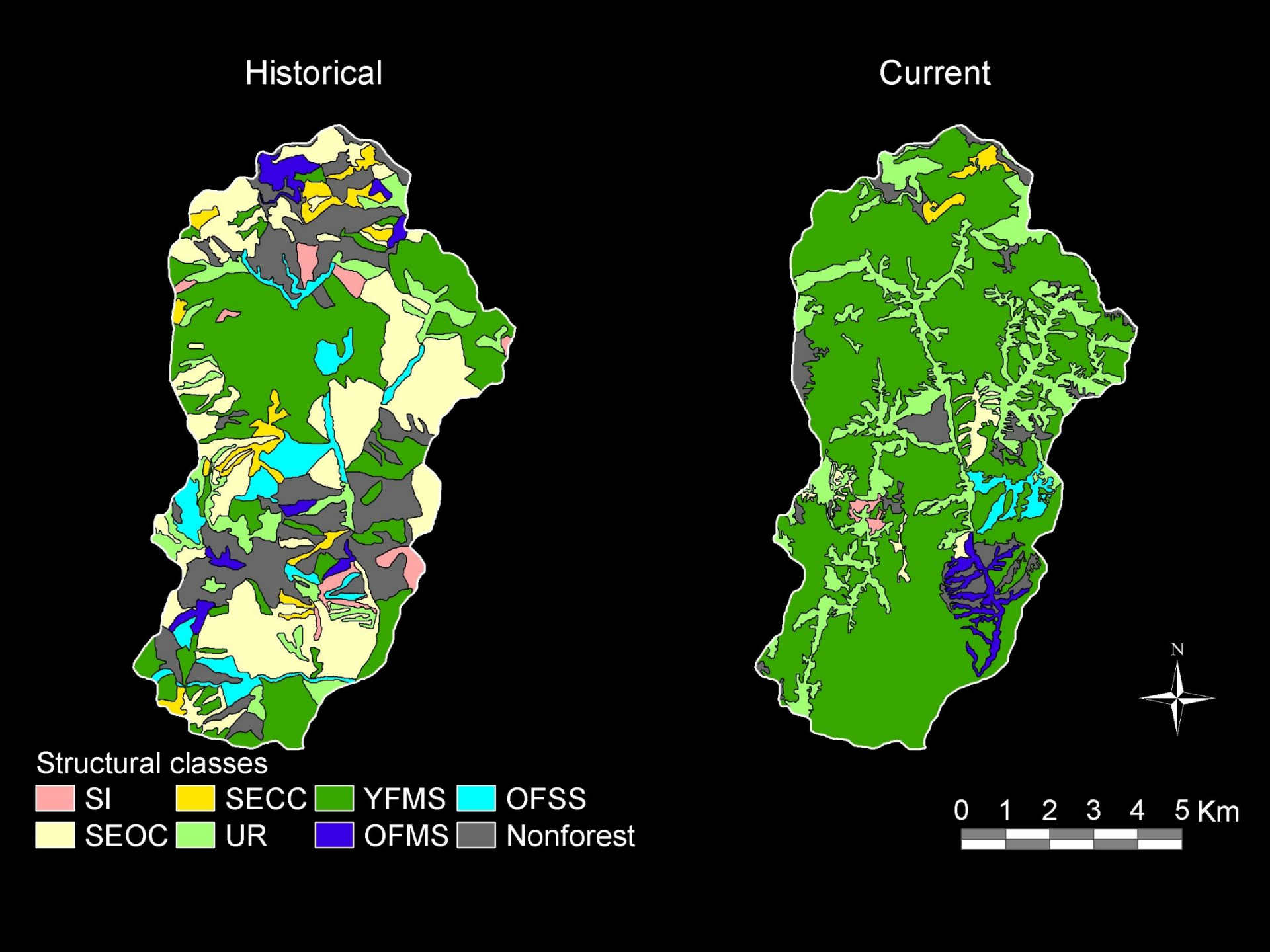

0
50
100 Feet




Ecological Subregions of the Interior Pacific Northwest
Ecological Subregions (ESR)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27 28 29 30 31 32 34 35 36 37
38 39 40 41 42 43 44 45 46 47 48 50 51 52 53 54 55
Sampled subwatersheds
N
W
E
S
0 50 100 150 200 250
Kilometers


Branch 1 (n = 349)
Branch 2 (n = 993)
Branch 5 (n = 378)
Branch 4 (n = 1292)
Branch 3 (n = 271)
Branch 6.1 (n = 644)
Branch 6.2 (n = 759)
Branch 7 (n = 450)
Branch 8 (n = 1119)
Branch 9.1 (n = 543)
Branch 9.2 (n = 258)
Branch 10 (n = 440)
41 4 5 6 13 53 8 11 14 21 7 10 16 30 12 17 3 2 1 19 20 18 23 38 39 37 15 26 29 36 32 35 25 24 34 54 31 27 45 9 48 47 33 49 42 44 46 40 22 28 51 55 52 50 43


Historical
Current
N
Cover types
PIPO
PICO
ABGR
Herbland
Nonforest
LAOC
PSME
ABLA2/PIEN
Shrubland
0 1 2 3 4 5 Km


Historical
Current
N
Structural classes
SI
SECC
YFMS
OFSS
SEOC
UR
OFMS
Nonforest
0 1 2 3 4 5 Km

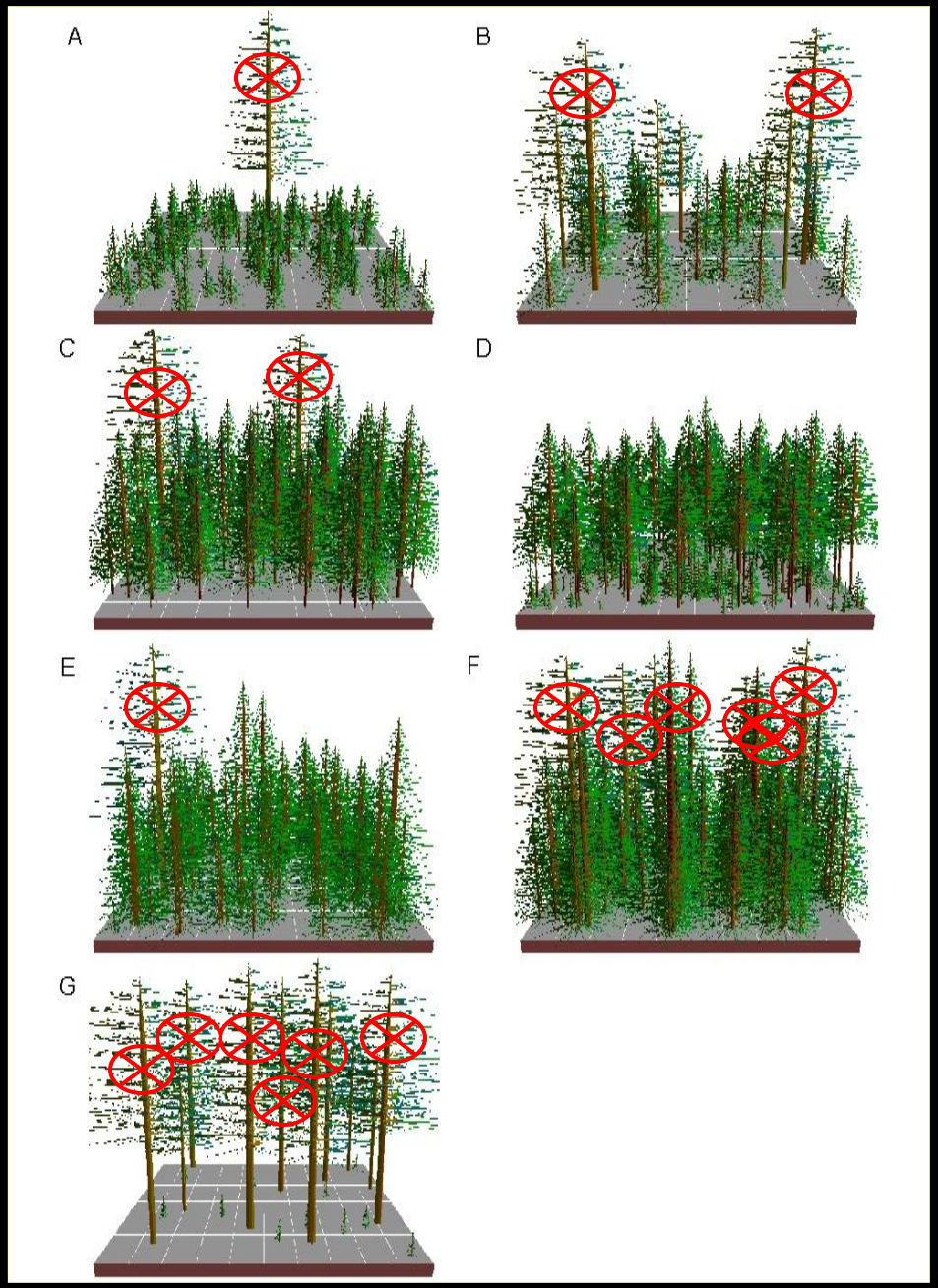
Forest Structural Classes

Stand initiation
(SI)

Stem Exclusion
Closed Canopy
(SECC)

Young Forest
Multi-Story
(YFMS)

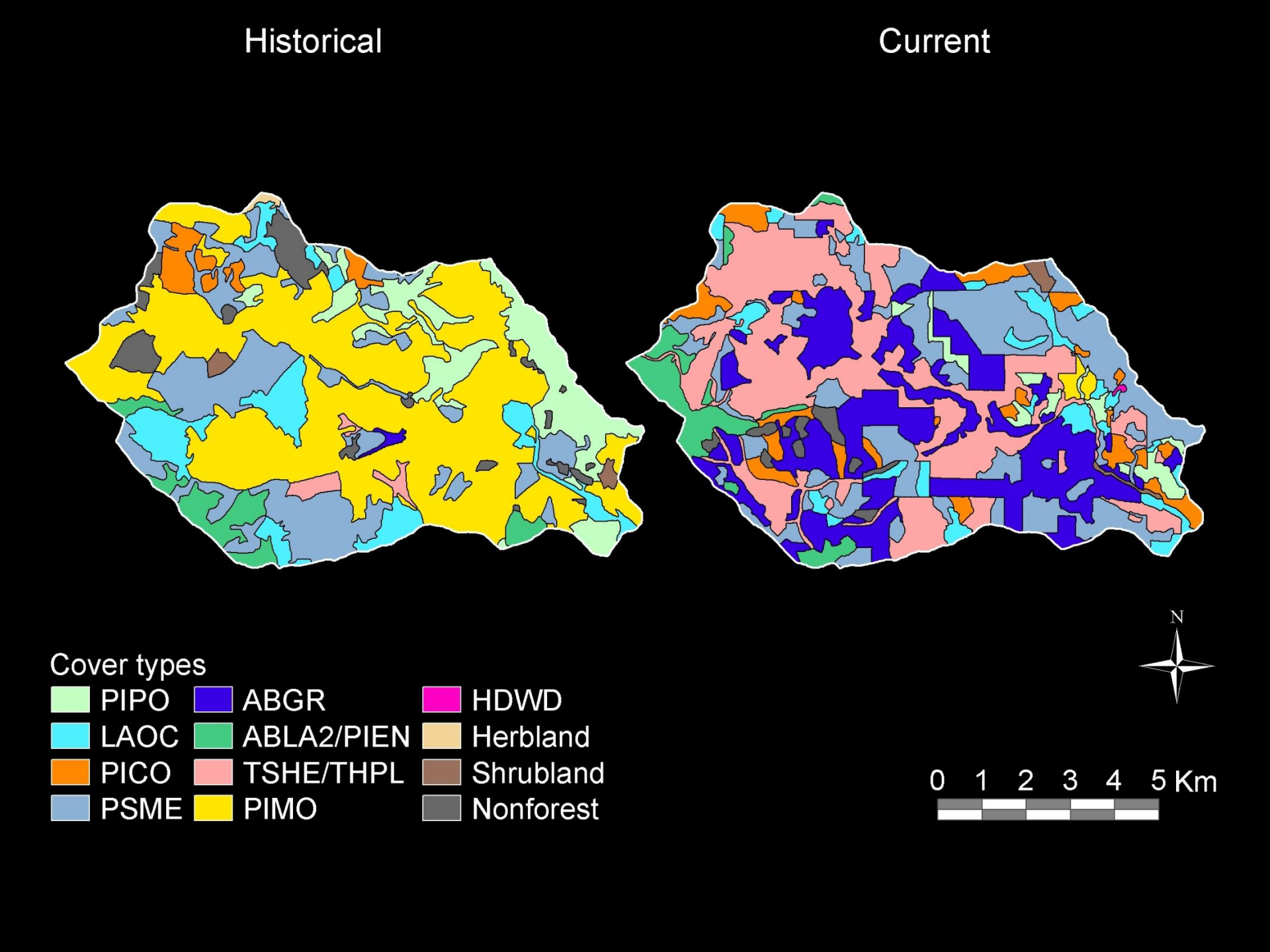
Old Forest
Single Story
(OFSS)

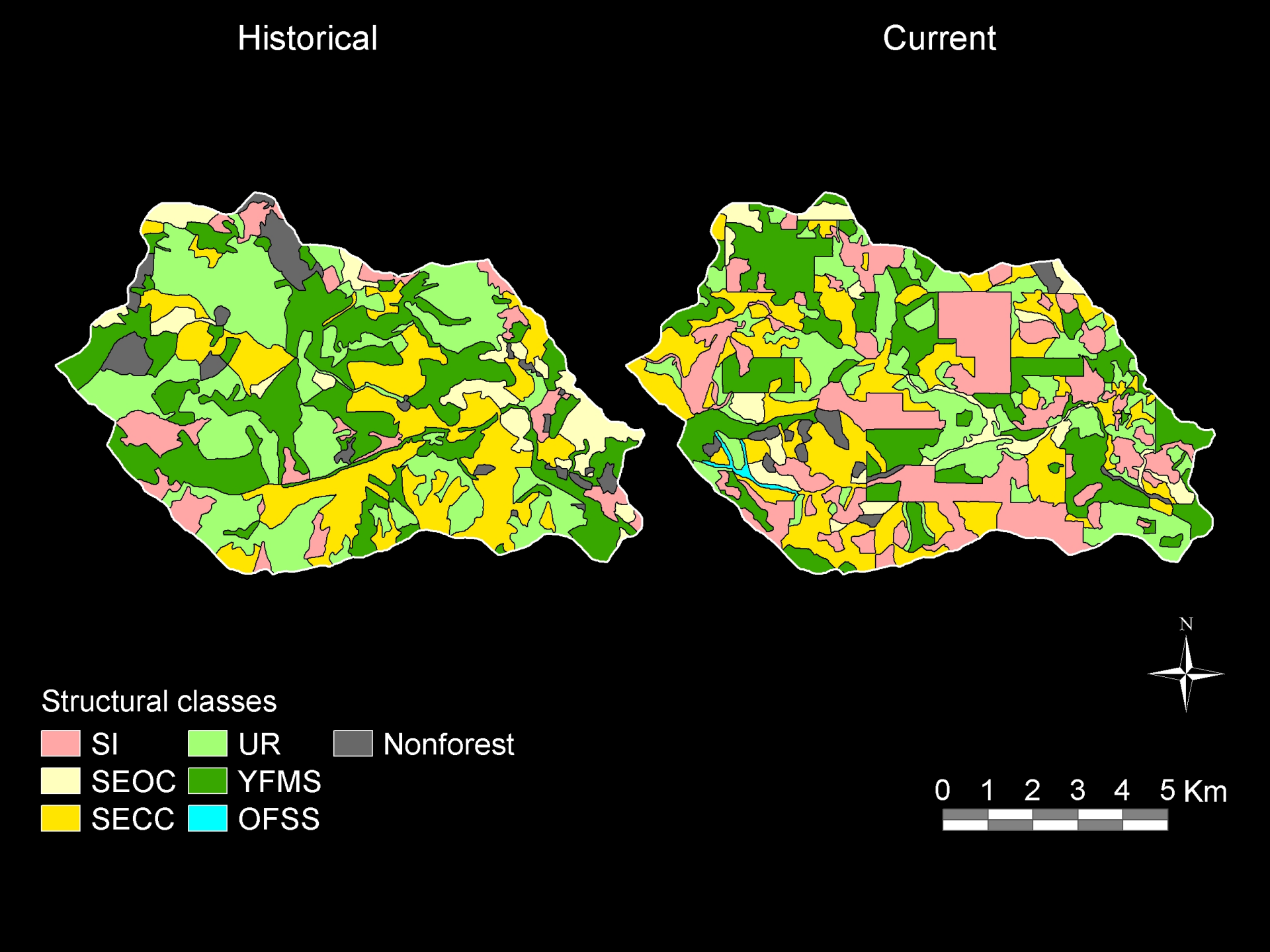


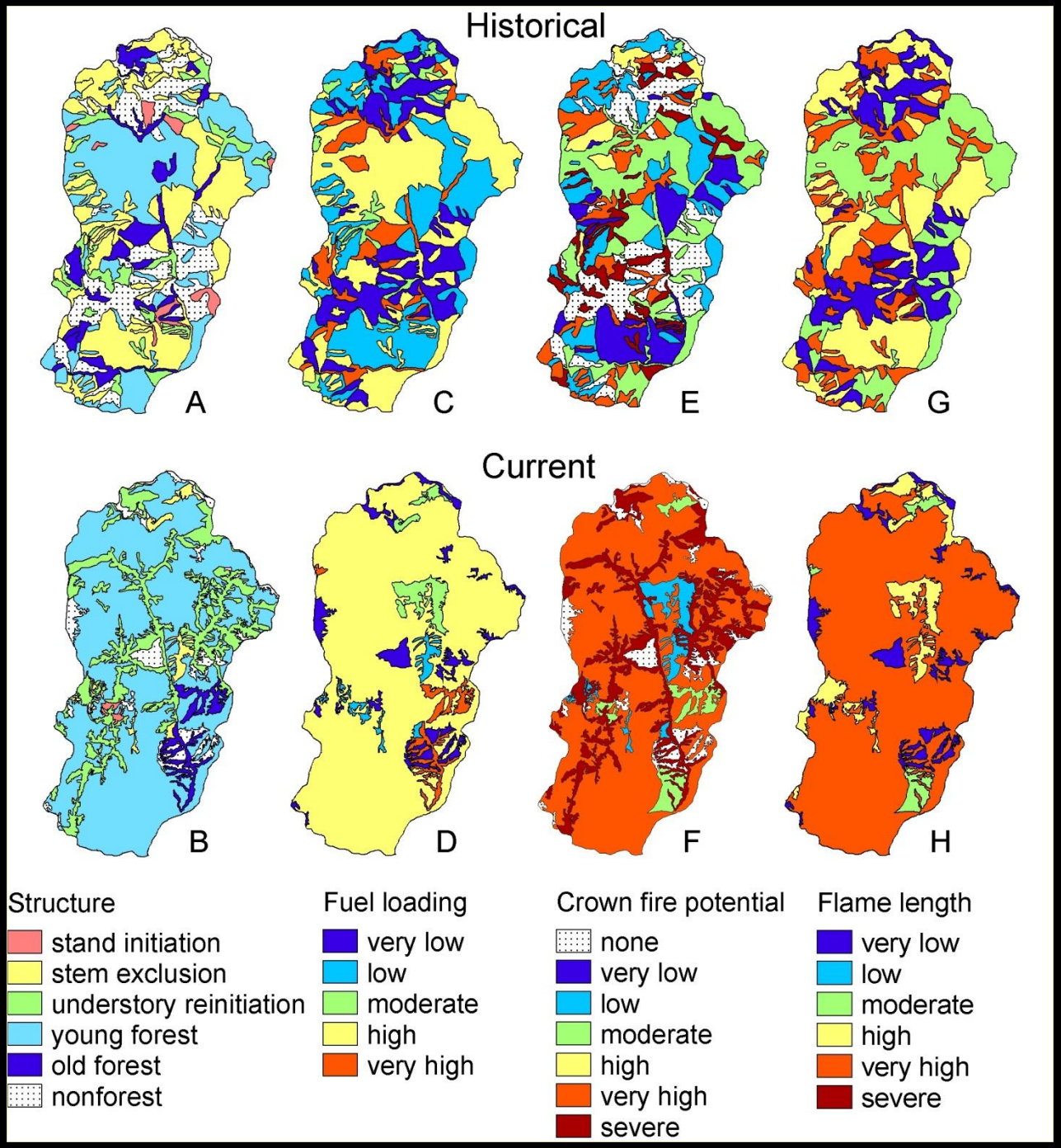
Stem Exclusion
Open Canopy
(SEOC)

Understory
Re-initiation
(UR)

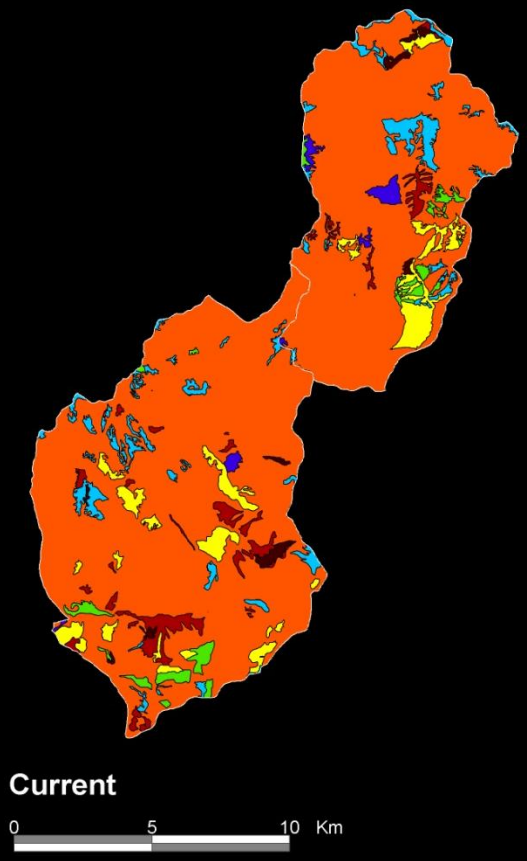
Old Forest
Multi-Story
(OFMS)

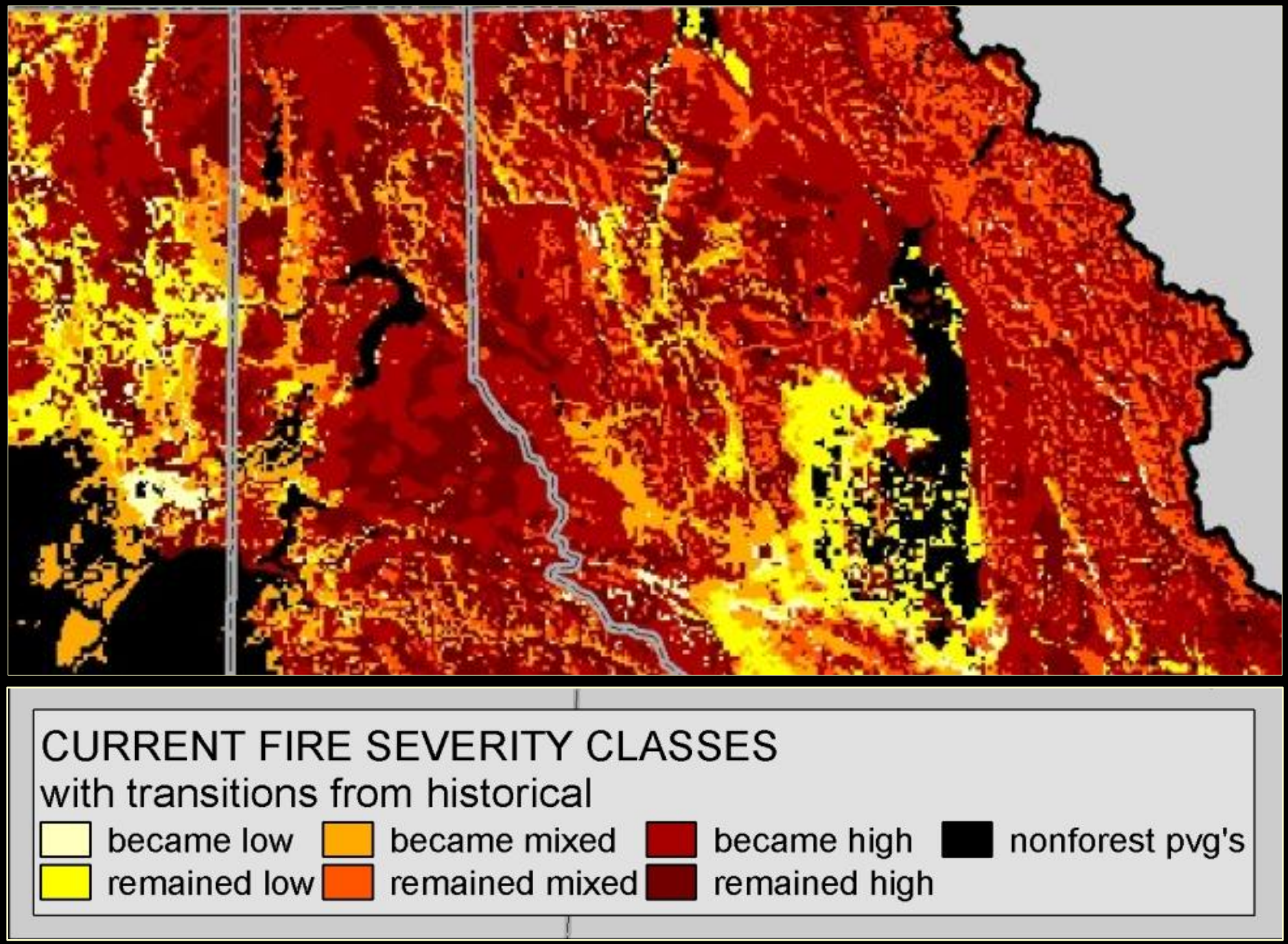

Historical
Current
Cover types
PIPO
LAOC
PICO
PSME
ABGR
ABLA2/PIEN
TSHE/THPL
PIMO
HDWD
Herbland
Shrubland
Nonforest
N
0 1 2 3 4 5 Km


Historical
Current
N
Structural classes
SI
SEOC
SECC
UR
YFMS
OFSS
Nonforest
0 1 2 3 4 5 Km

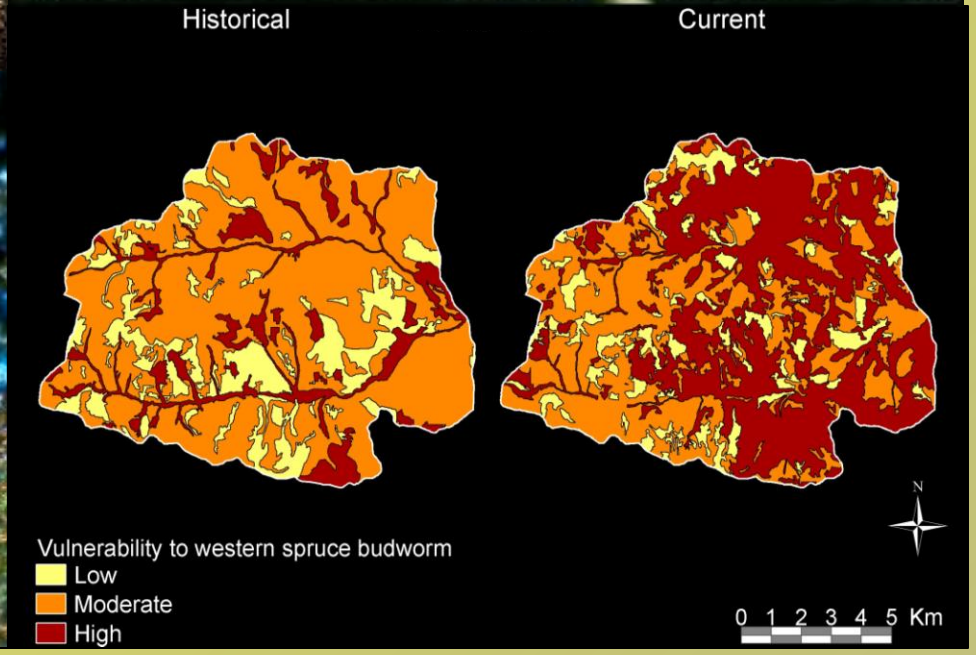


Sum of standardized FL, ROS, FLI, CFP scores

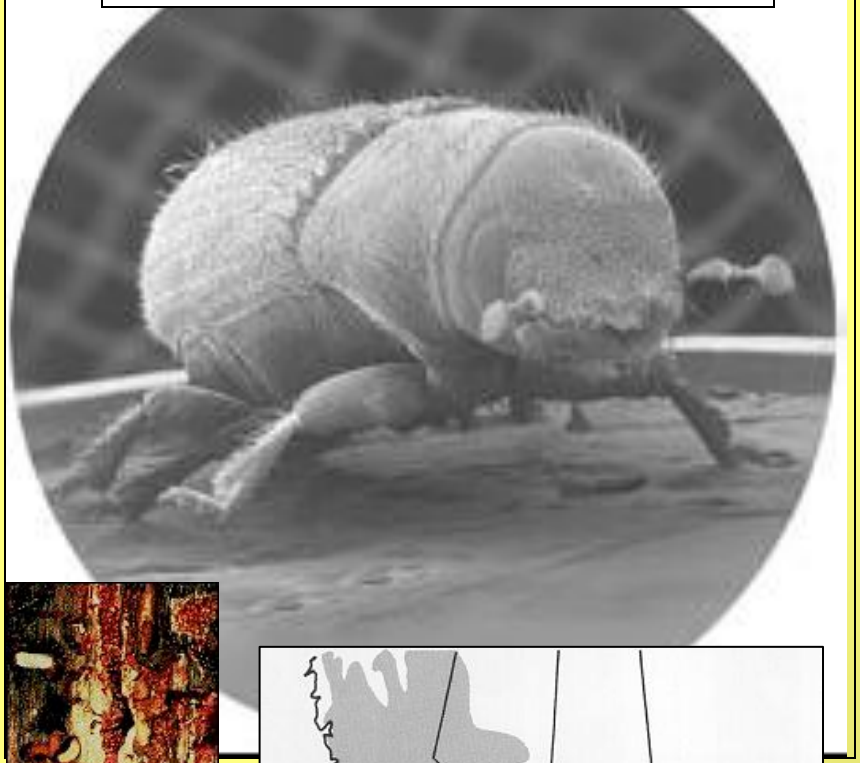


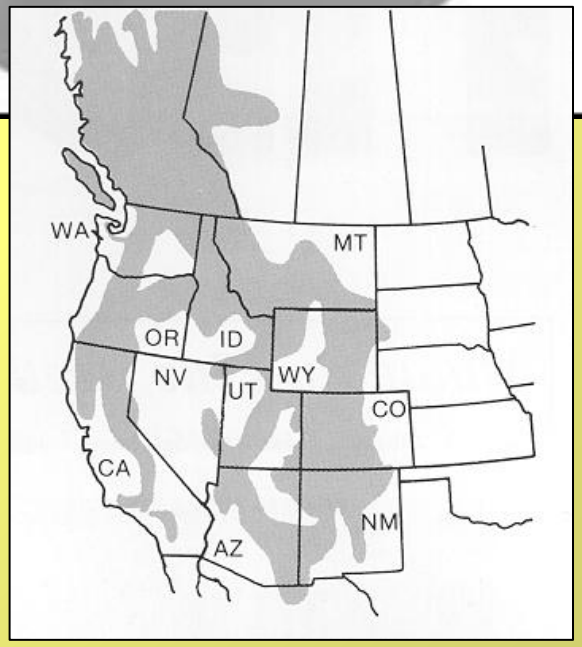

CURRENT FIRE SEVERITY CLASSES
with transitions from historical
became low
remained low
became mixed
remained mixed
became high
remained high
nonforest pvg's

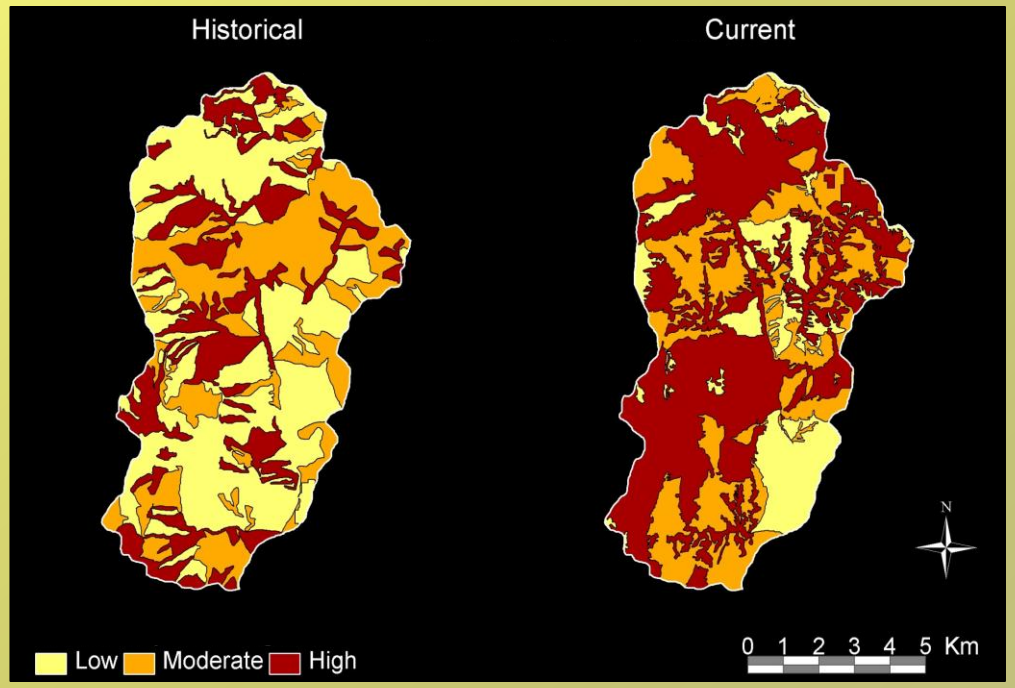
Western spruce budworm

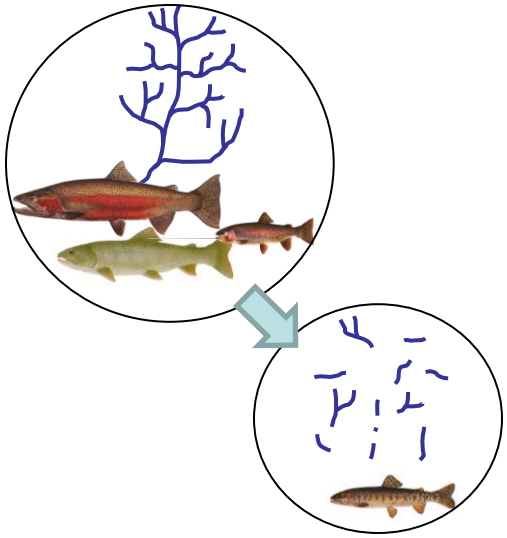


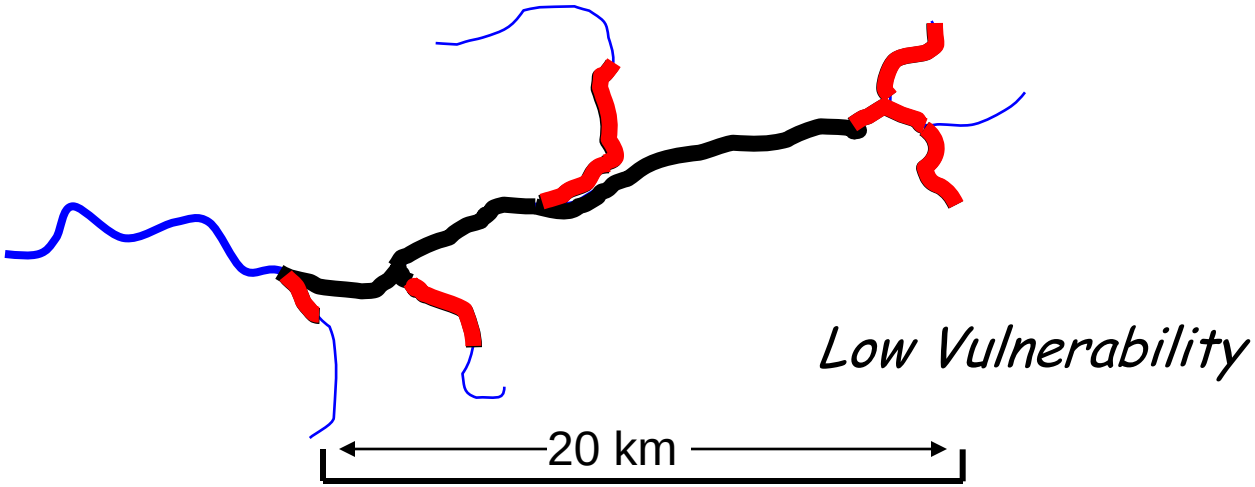
Mountain pine beetle

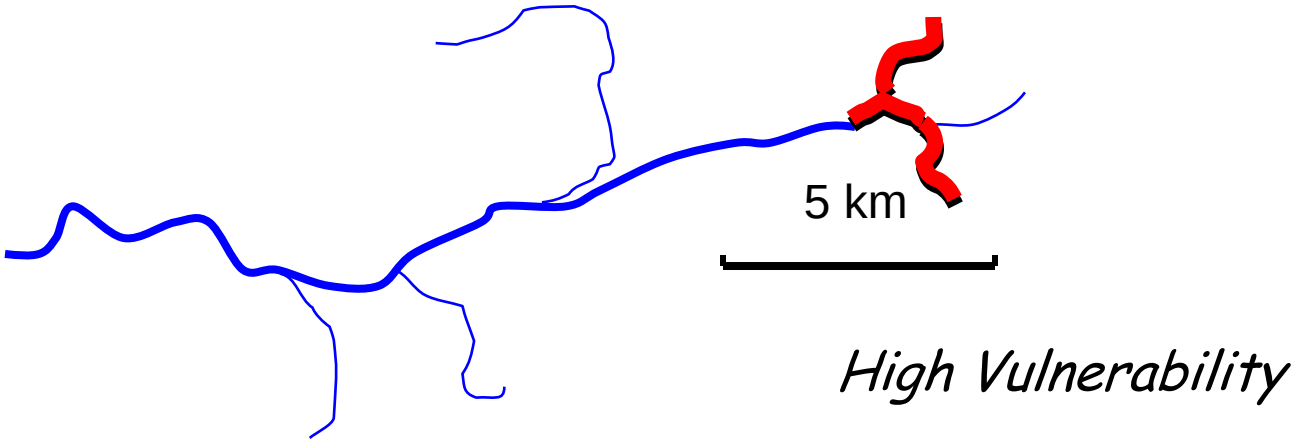


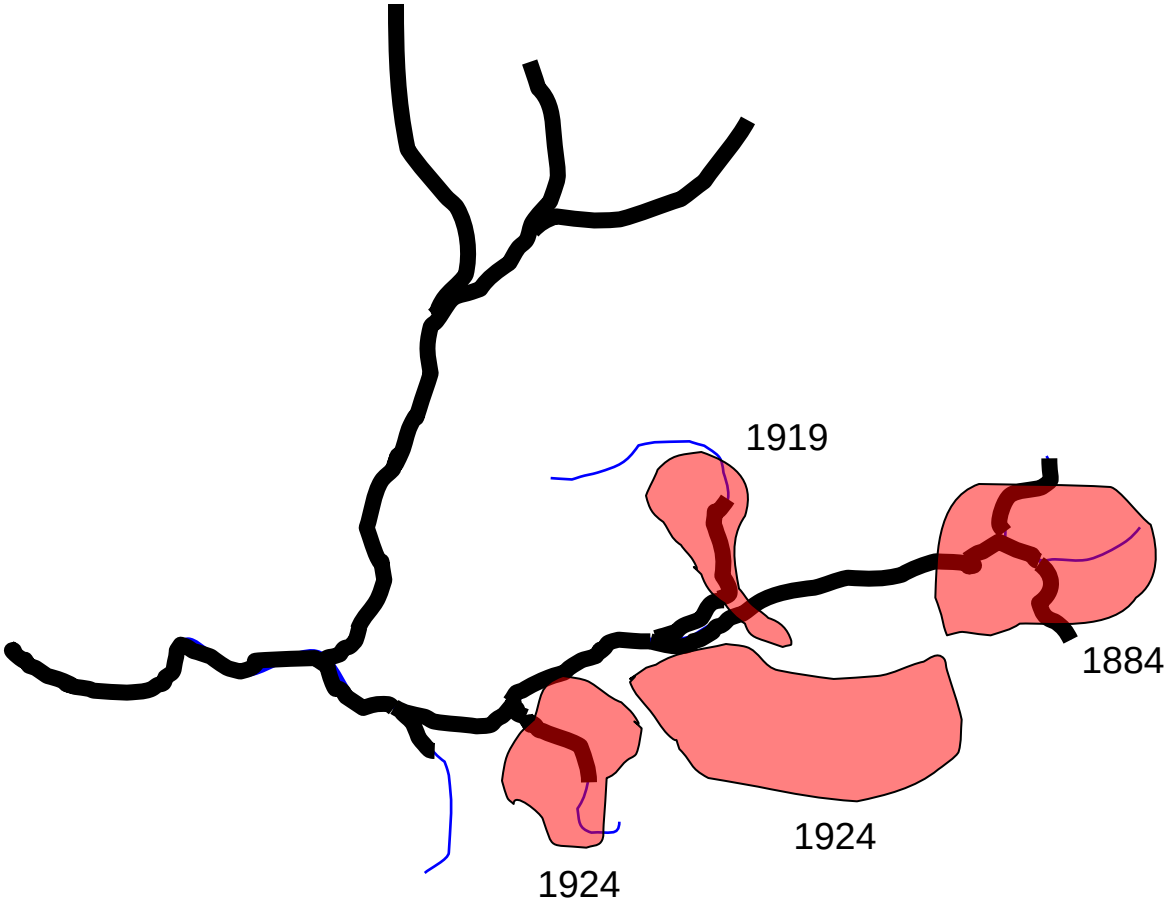


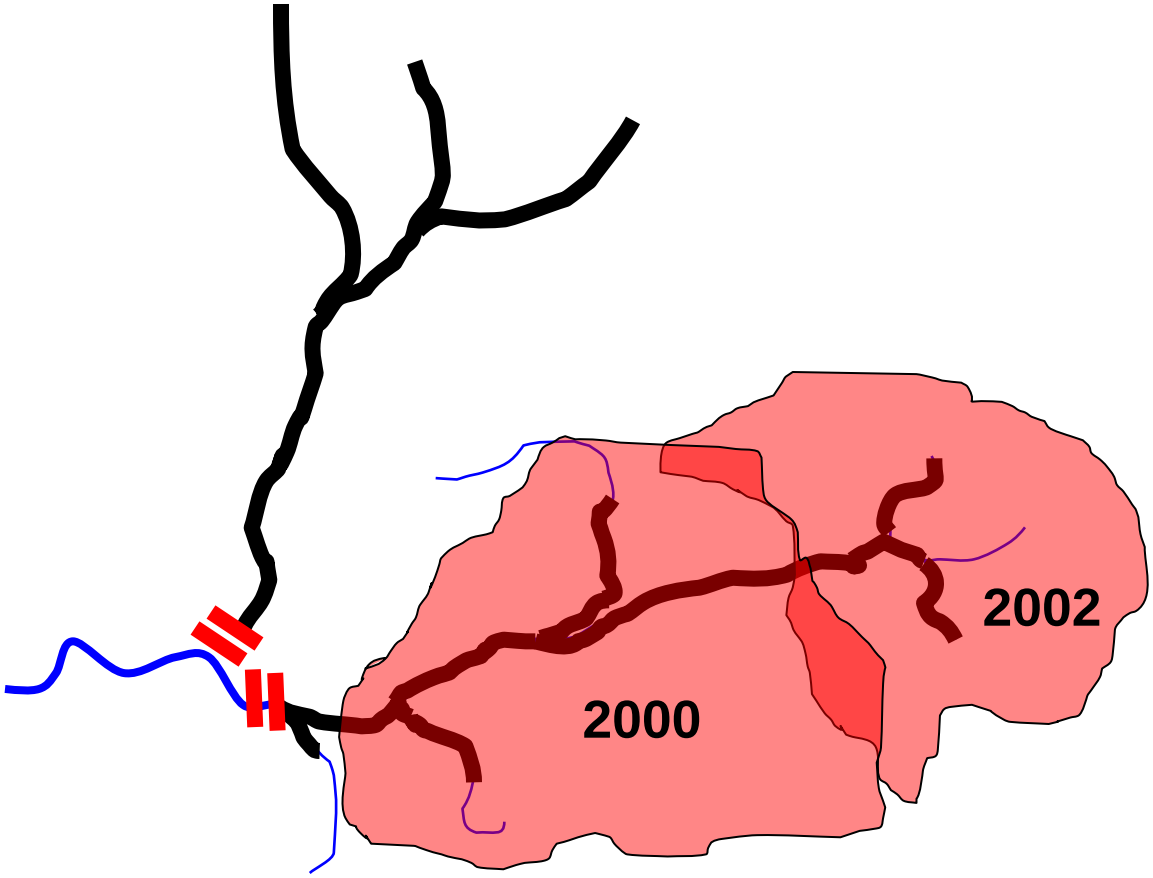


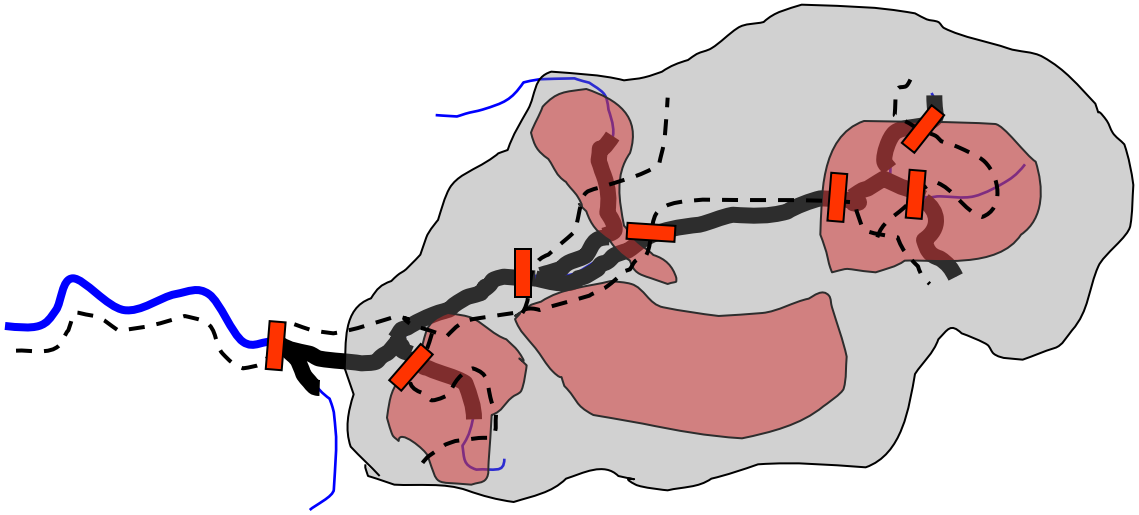



Low Vulnerability
20 km

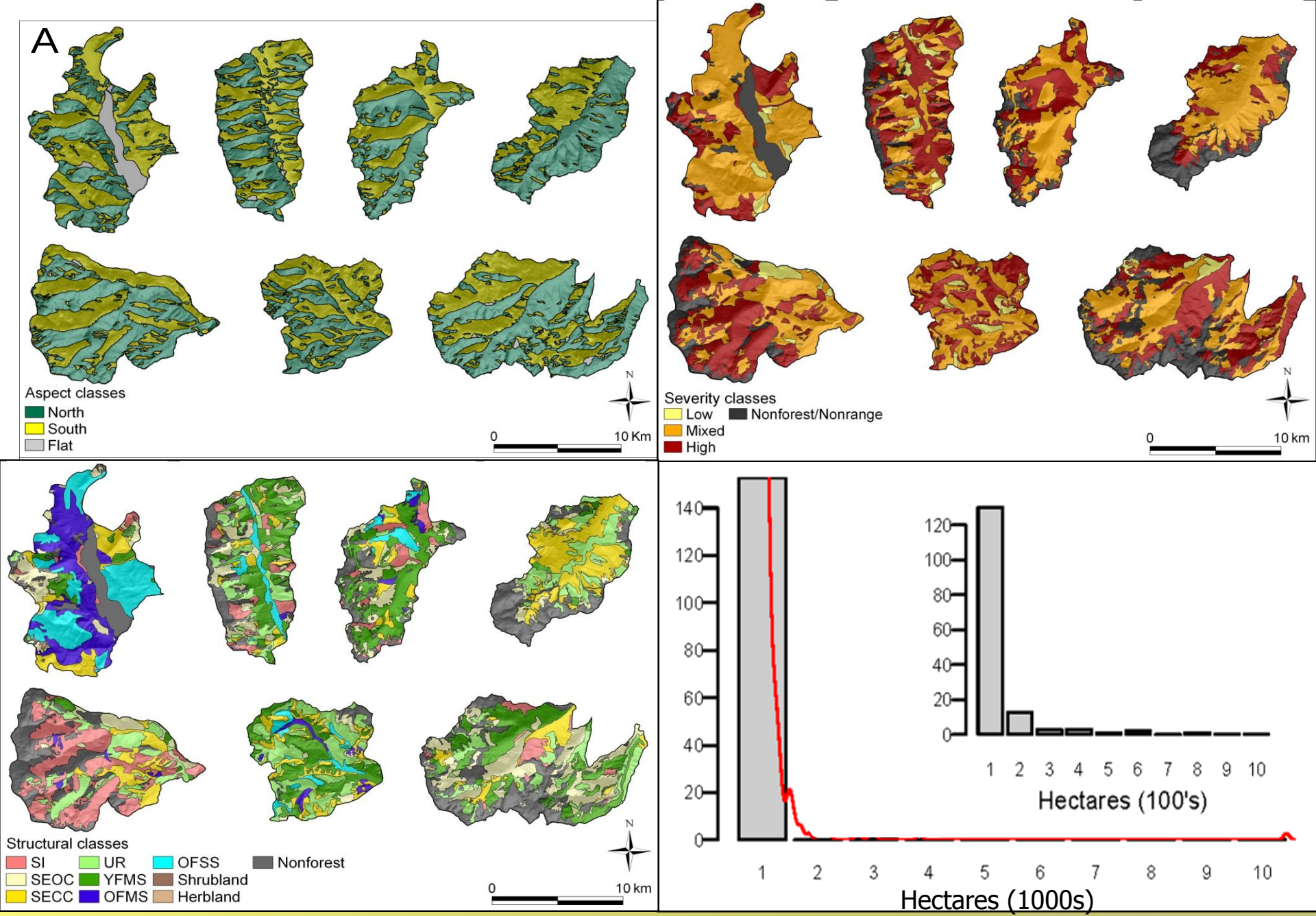

5 km
High Vulnerability


1919
1884
1924
1924


2000
2002



Before | After



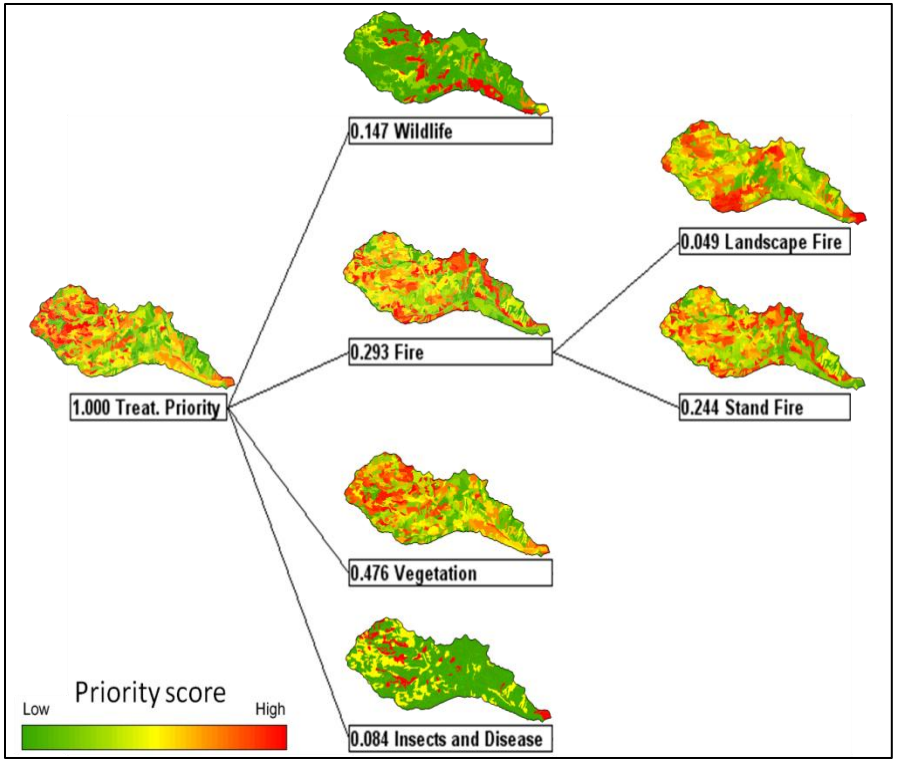
Vegetation-Topography-Fire severity linkages

Challenges:

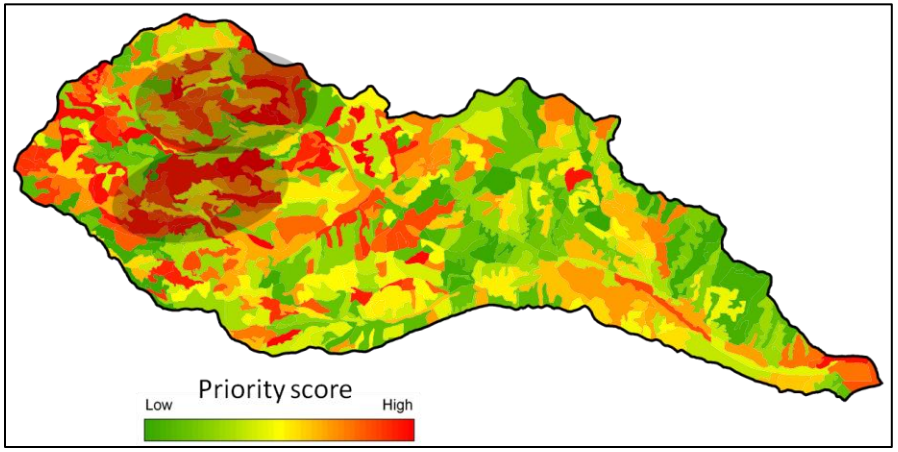
- Listed terrestrial/aquatic species
- Fragmented habitats
- Sustainable timber harvest
- Large and severe wildfires
- Fire suppression
- Simple forest structural and compositional patterns
- Roads/sediment
- Fish barriers

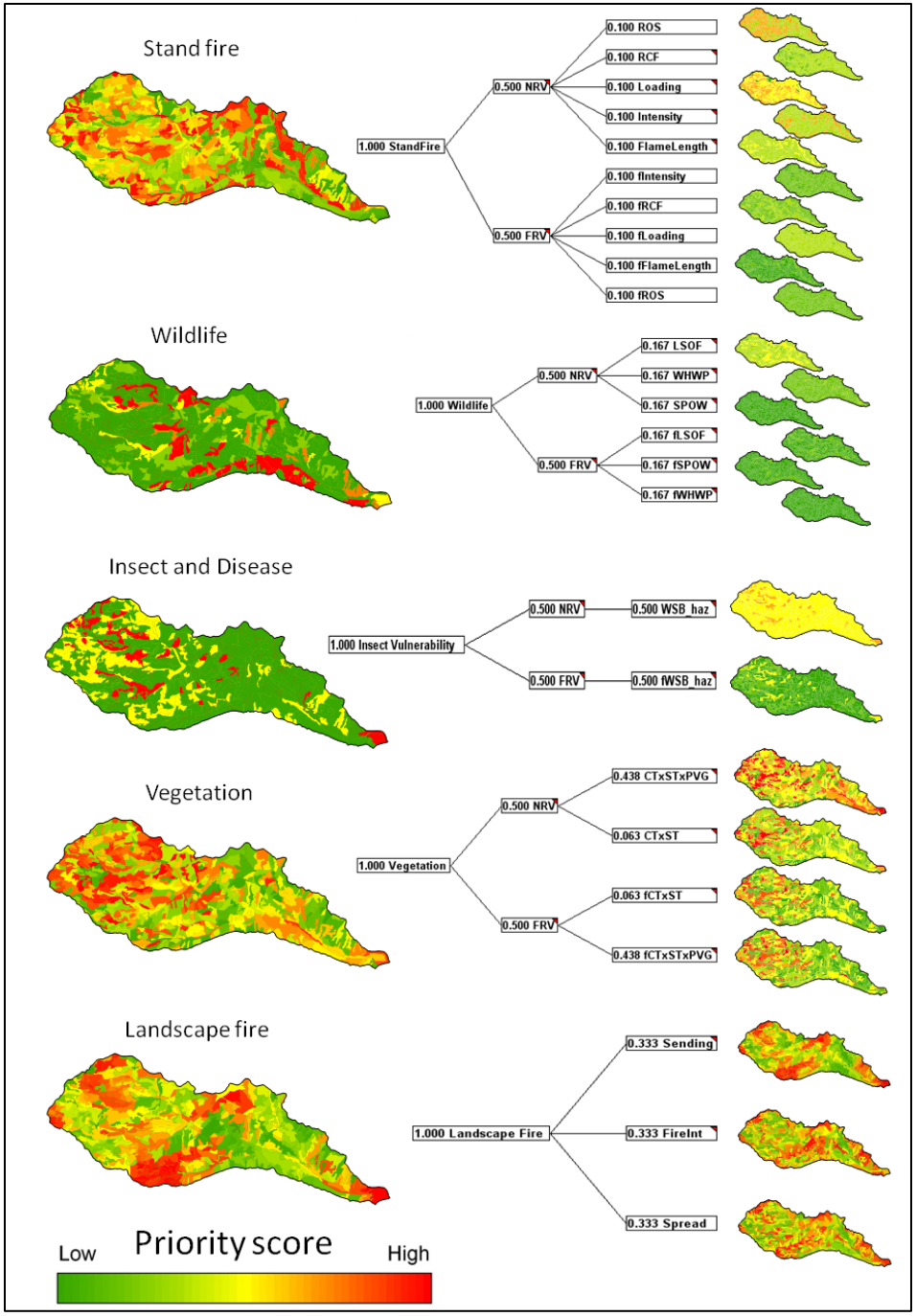
Options:

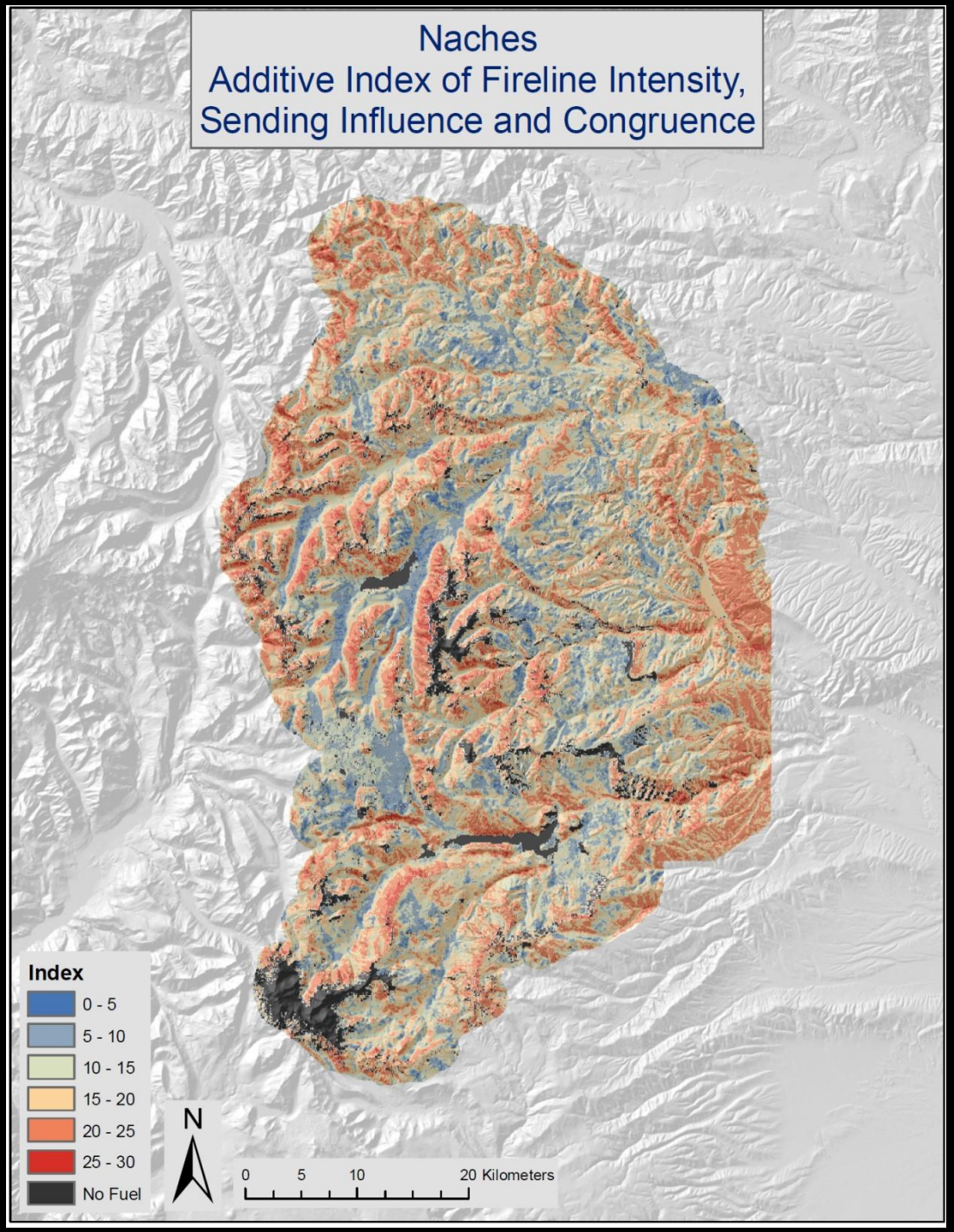
- Maintain strongholds, make more
- Model HRV and FRV departures
- Biomass → landscape restoration
- Restore spatial controls on fires
- Continue + increase Rx burning
- Restore complex PSDs
- Restore patterns → fire regimes
- Identify/address influential roads
- Remove/resize/redesign

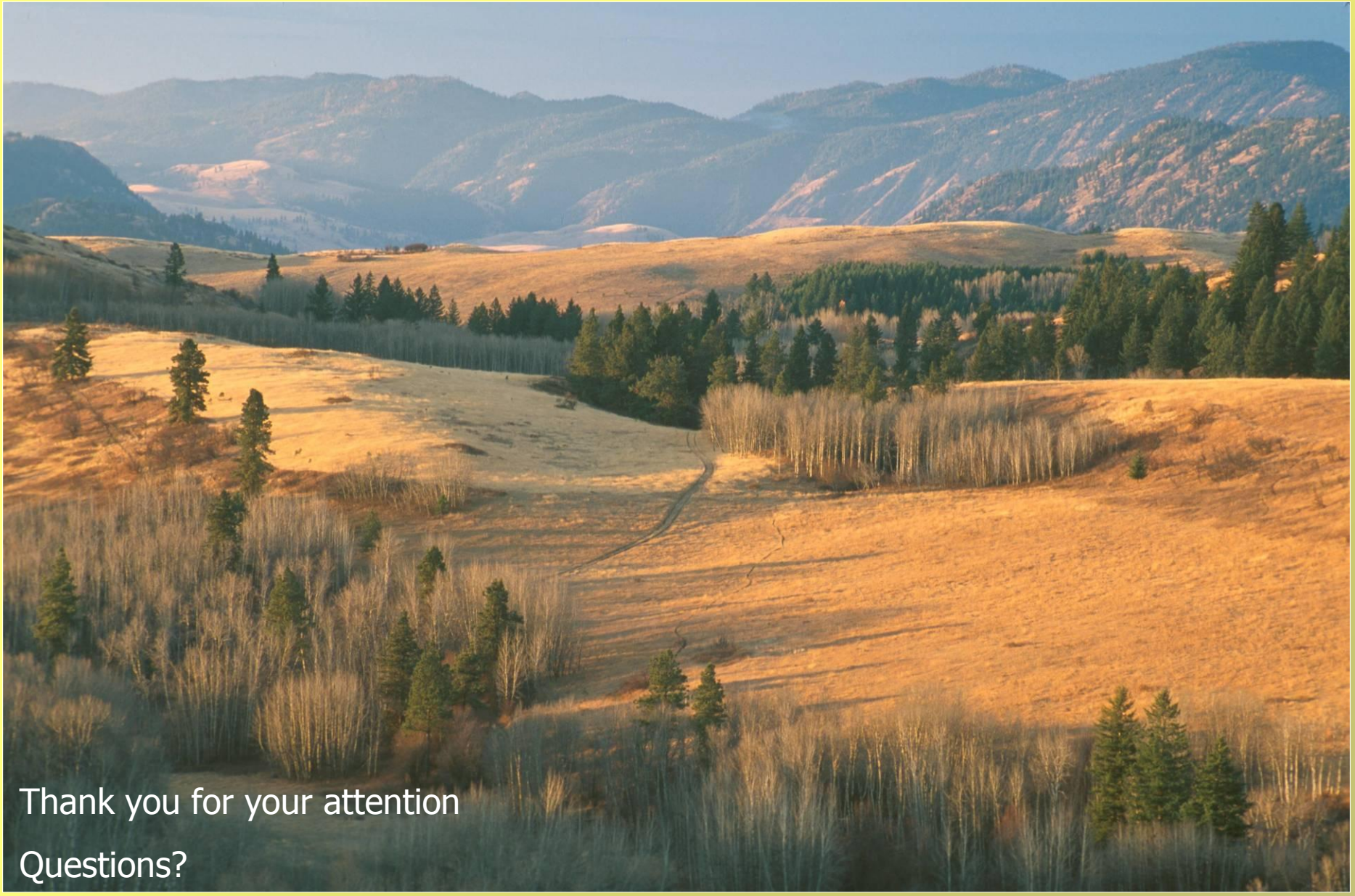


OKA-WEN restoration planning model (EMDS)






Naches
Additive Index of Fireline Intensity,
Sending Influence and Congruence
Index
0 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 - 30
No Fuel
N
0
5
10
20 Kilometers



Thank you for your attention

Questions?