

**CMP – A cautionary note re analysis. The cliome projections by SNAP were published 7 years ago, and are based on climate projections & scenarios from early-mid 2000s.**


















From Rowland et al. (2016): “SNAP-EWHALE (2012) produced projected spatial configurations of the 18 cliomes across Alaska, Yukon and Northwest Territories using Random Forests™ (Breiman, 2001) based on climate model outputs from five CMIP3 GCMs selected for their accuracy in northern regions (ECHAM5, MIROC, CCCMA, GDFL, MIROC; (Walsh et al., 2008)).”

From Walsh et al. (2008): “Our evaluation is based on the twentieth-century simulations by the models used in the Fourth Assessment Report (AR4) of the IPCC (Solomon et al. 2007). These models are being used in the third phase of the Climate Model Intercomparison Project (CMIP; information available online at <http://www-pcmdi.llnl.gov/projects/cmip/index.php>) and hereafter are referred to as the CMIP3 models.”

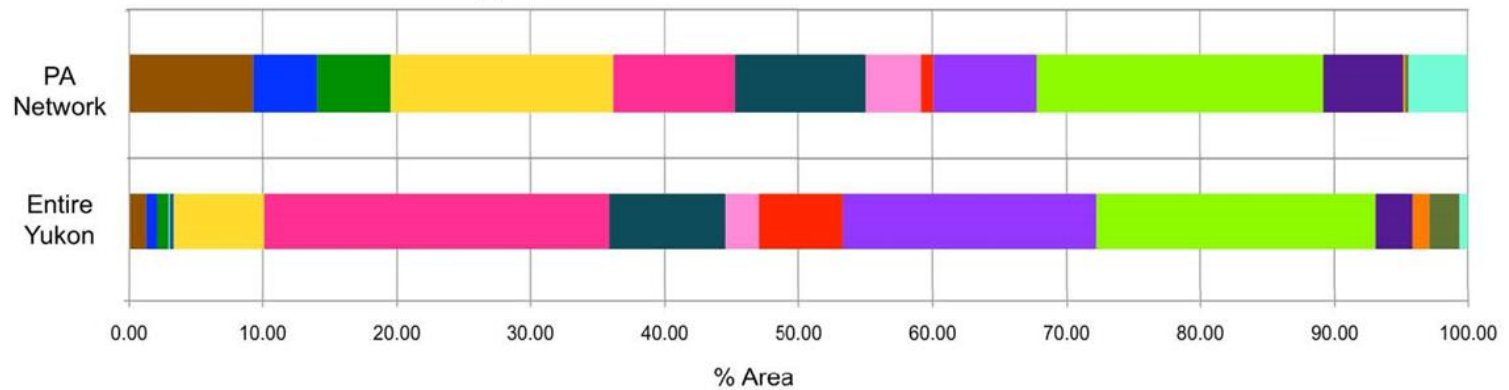
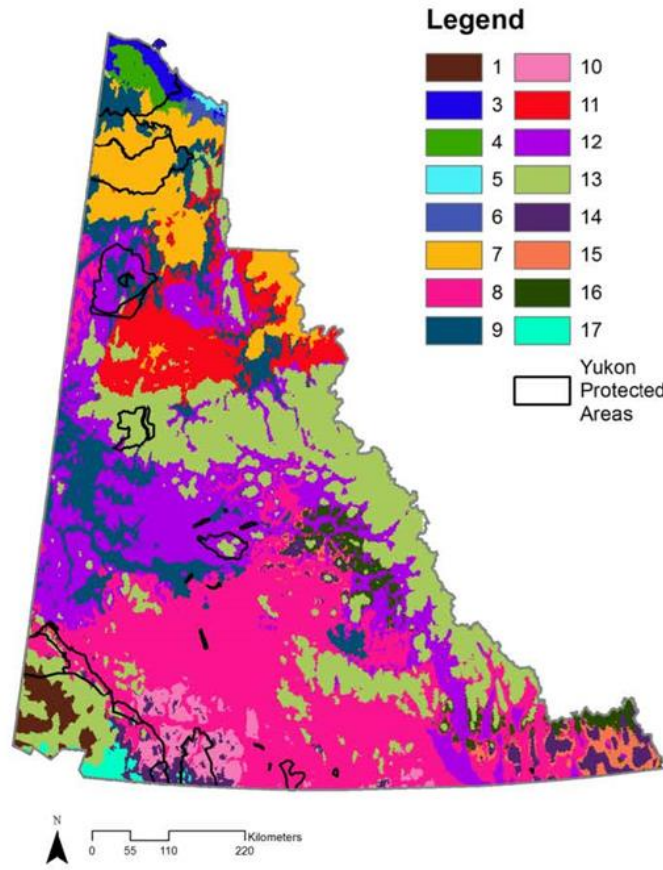
Walsh, J.E., Chapman, W.L., Romanovsky, V., Christensen, J.H., Stendel, M., 2008. Global climate model performance over Alaska and Greenland. *J. Clim.* 21, 6156–6174. <http://dx.doi.org/10.1175/2008JCLI2163.1>.

**Also, we used the A2 emissions scenario. Our comments on that choice below. I don’t know how it compares with the more recent projections & scenarios.**

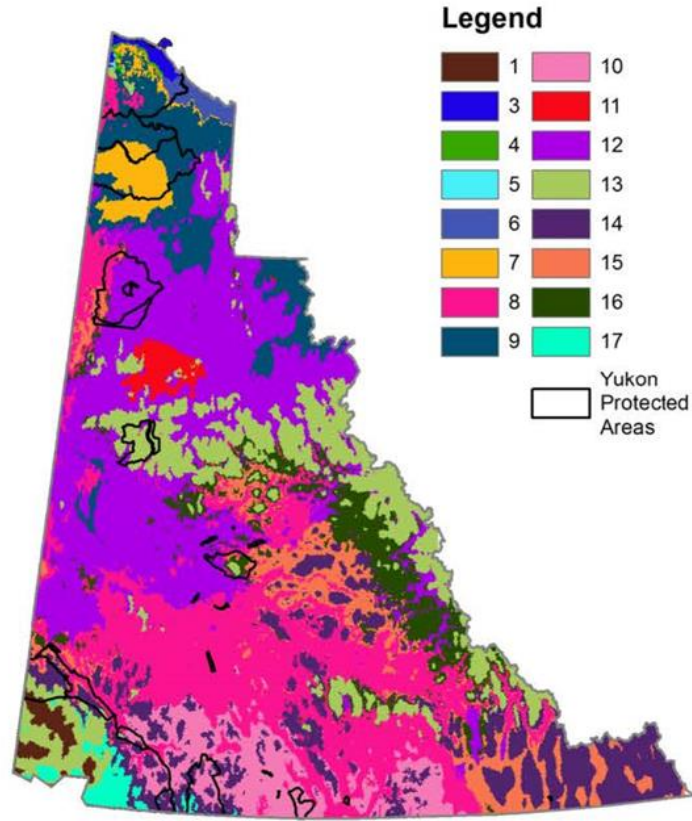
From Rowland et al. (2016): “For our Yukon analysis, we used the cliomes generated with the five-model composite (average) climate projections of the A2 emissions scenario (Nakicenovic et al., 2000)... A comparison of cliome outputs between the A1B and A2 scenarios for the Yukon PAs showed some differences. However, because output from different emission scenarios does not diverge greatly until after mid-century (Knutti and Sedláèek, 2013), we used output from the A2 scenario only in our analyses. Moreover, studies show this to be the most consistent with respect to current emission trends (Fussel, 2009; Peters et al., 2013), and thus may accurately reflect changes at the end of the 21<sup>st</sup> century. Although the IPCC’s most recent report, the fifth Assessment Report, refers to four Representative Concentration Pathways (RCPs) rather than the scenarios described in the Special Report on Emissions Scenarios published in 2000, the slightly older CMIP3 model outputs used in this analysis are still relevant within the new framework (Knutti and Sedláèek, 2013).”

<b>CLIOME</b>	<b>BIOME / LAND COVER-BASED DESCRIPTION</b>
 1	Northern Arctic sparsely vegetated tundra, <25% bare ground & ice, extremely short growing season
 3	More densely vegetated arctic tundra with up to 40% shrubs but no tree cover
 4	Arctic tundra with denser vegetation and more shrub cover including some small trees
 5	Dry sparsely vegetated southern arctic tundra
 6	Northern boreal/southern arctic shrubland, with an open canopy
 7	Northern boreal coniferous woodland, open canopy
 8	Dry boreal wooded grasslands-mixed coniferous forests and grasses
 9	Mixed boreal forest
 10	Boreal forest with coastal influence and intermixed grass and tundra
 11	Cold northern boreal forest
 12	More densely forested closed-canopy boreal
 13	Sparsely vegetated boreal with elevation influences
 14	Densely forested southern boreal
 15	Southern boreal/aspen parkland
 16	Southern boreal, mixed forest
 17	Coastal rainforest, wet, more temperate
 18	Prairie and grasslands

# 1961-1990

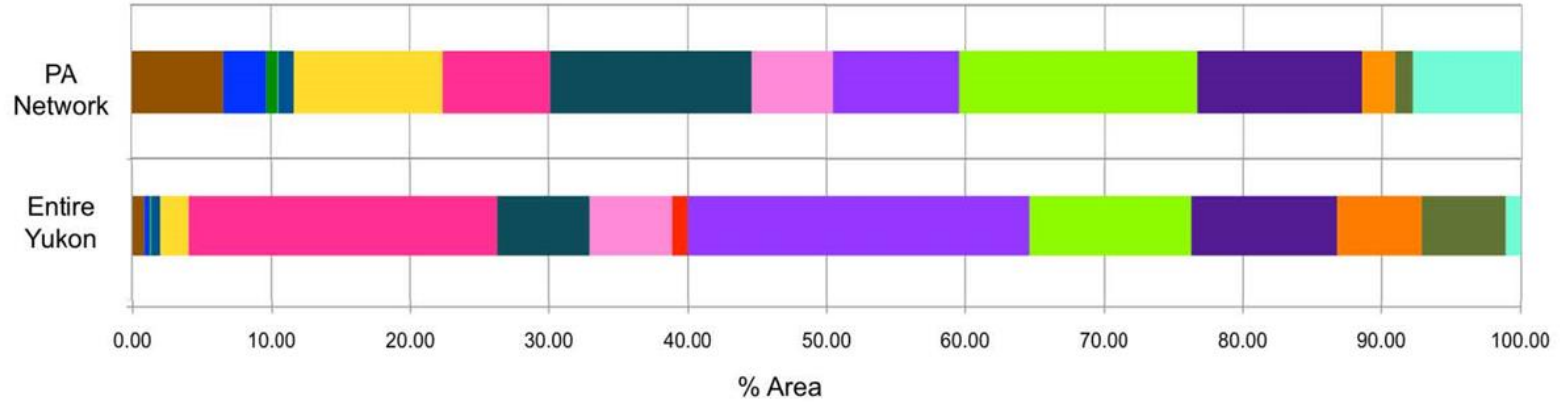
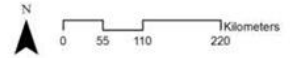


# 2030s

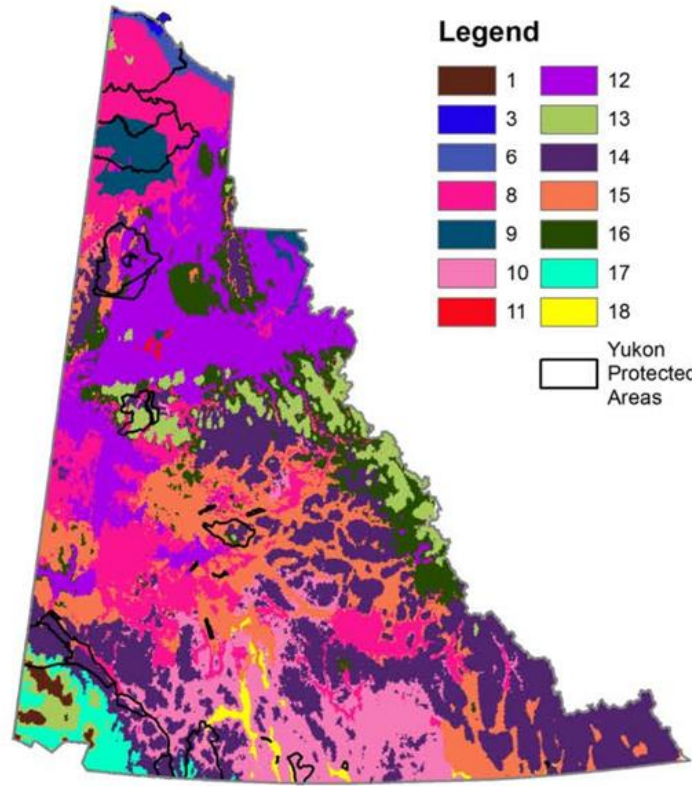


**Legend**

- |                       |    |
|-----------------------|----|
| 1                     | 10 |
| 3                     | 11 |
| 4                     | 12 |
| 5                     | 13 |
| 6                     | 14 |
| 7                     | 15 |
| 8                     | 16 |
| 9                     | 17 |
| Yukon Protected Areas |    |

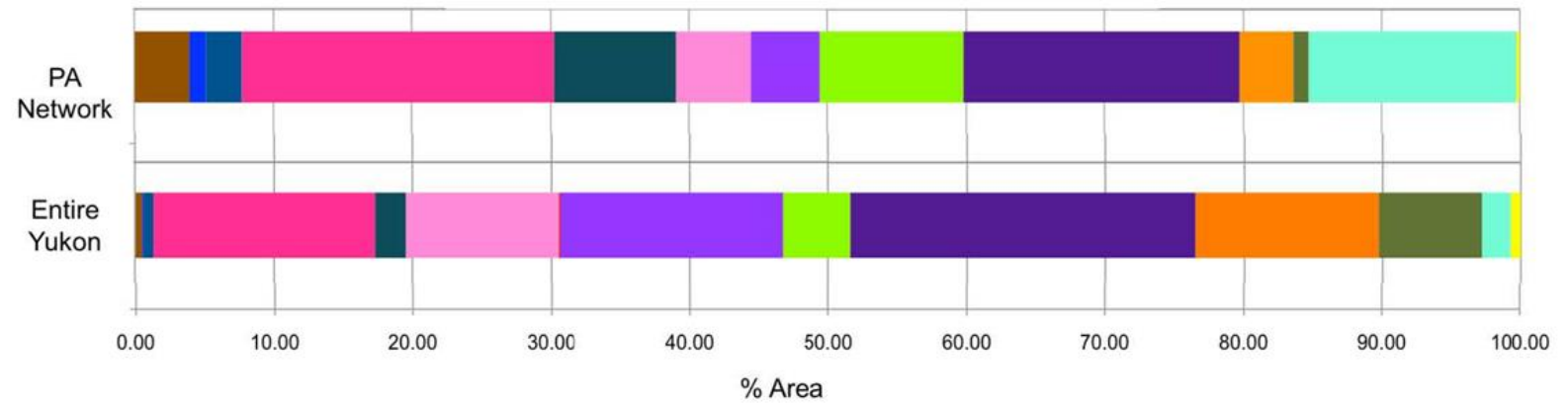
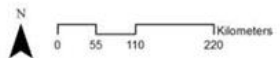


# 2060s

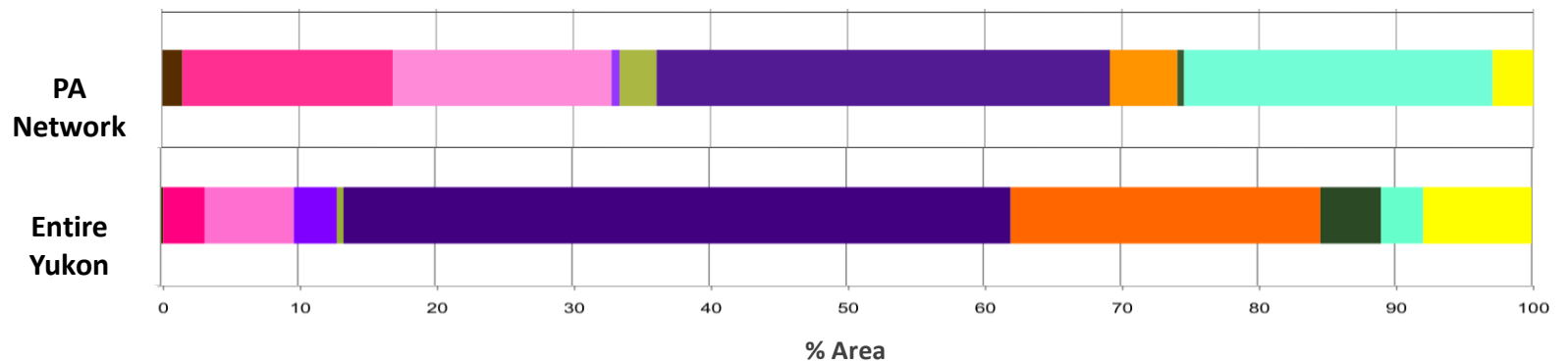
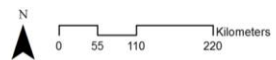
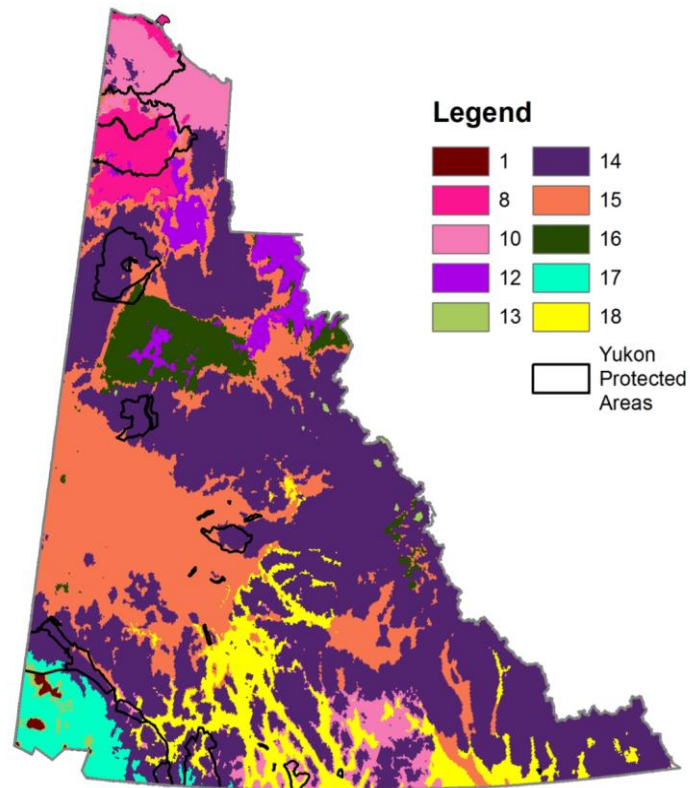


## Legend

- |   |    |   |                       |
|---|----|---|-----------------------|
|  | 1  |  | 12                    |
|  | 3  |  | 13                    |
|  | 6  |  | 14                    |
|  | 8  |  | 15                    |
|  | 9  |  | 16                    |
|  | 10 |  | 17                    |
|  | 11 |  | 18                    |
|   |    |  | Yukon Protected Areas |

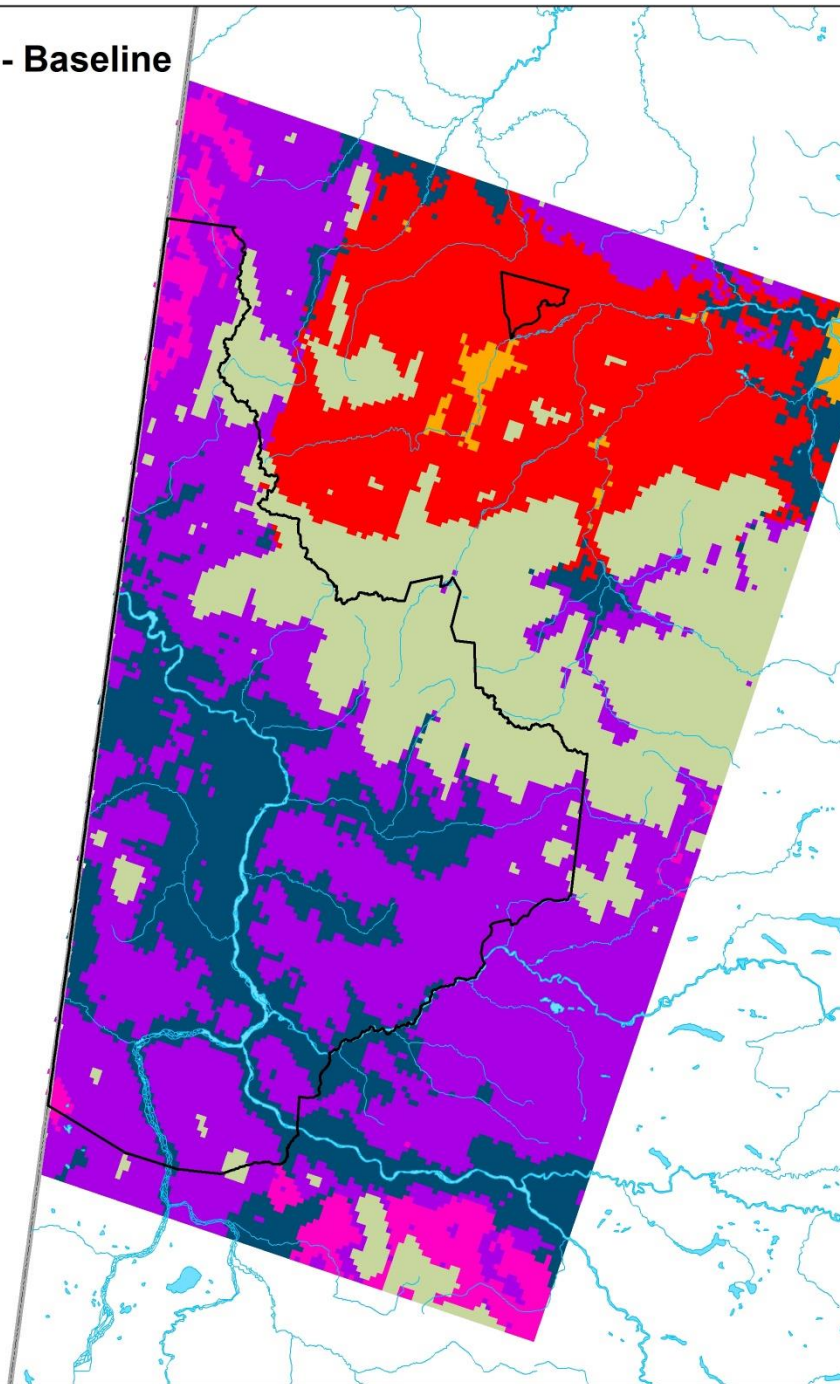
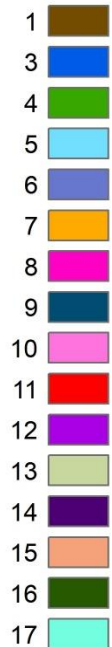


# 2090s



## CLIOMES - Baseline

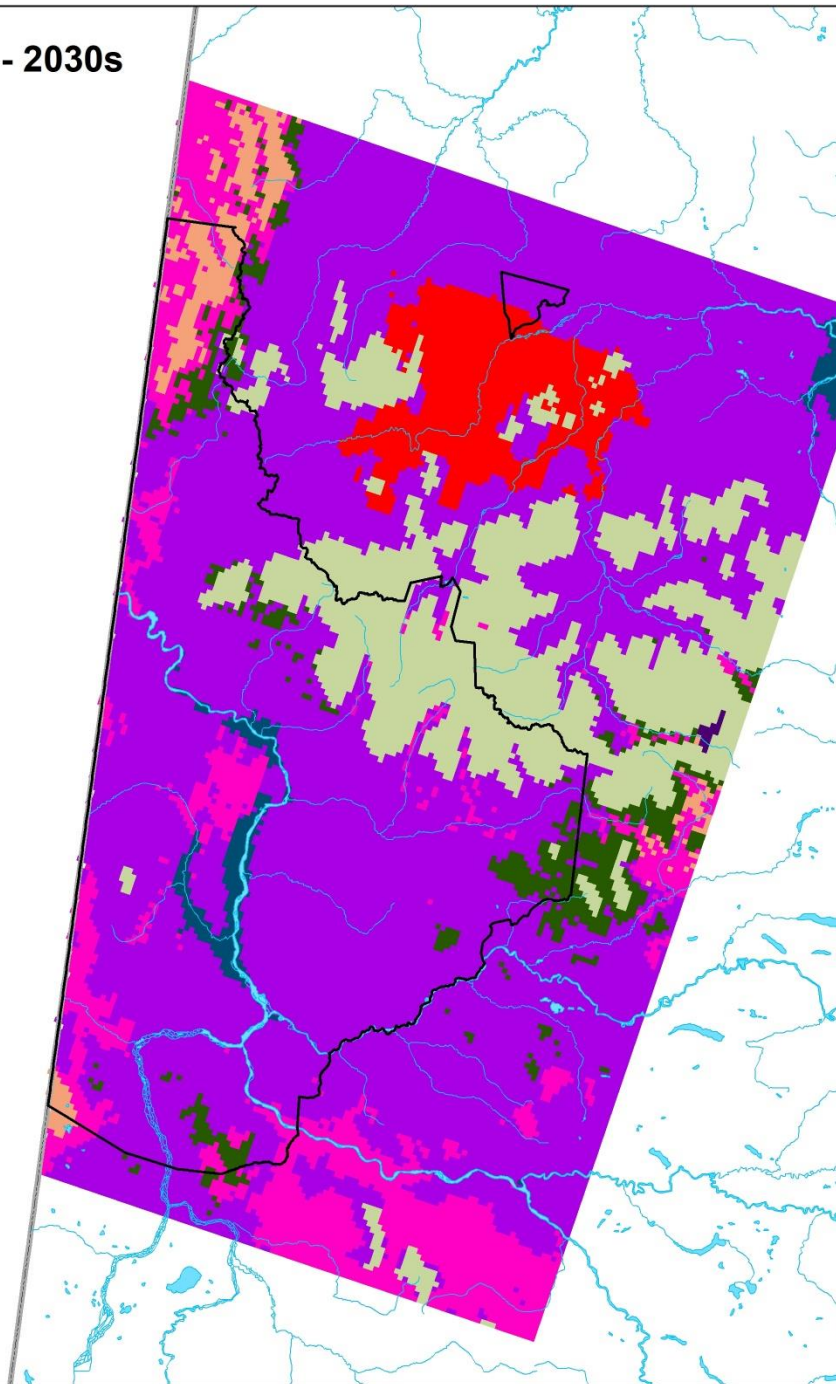
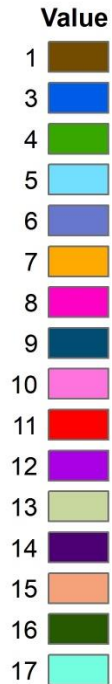
### Value



## Highlights

- Dominant cliomes are 9, 12, 13; also coverage of 8
- Cliome 9 (mixed boreal forest) prevalent along Yukon river drainage
- Cliome 12 (more densely forested closed-canopy boreal) at mid-elevations
- Cliome 13 (sparsely vegetated boreal with elevation influences) at higher elevations in Oglivie Mtns.
- Cliome 8 (dry boreal wooded grasslands-mixed coniferous forests and grasses) is present in small amount.
- Dawson region has large proportion of the total Yukon availability of cliome 9. This cliome should be protected in the short-term while also planning for connectivity to ensure opportunities for adaption through dispersal to northern Yukon.

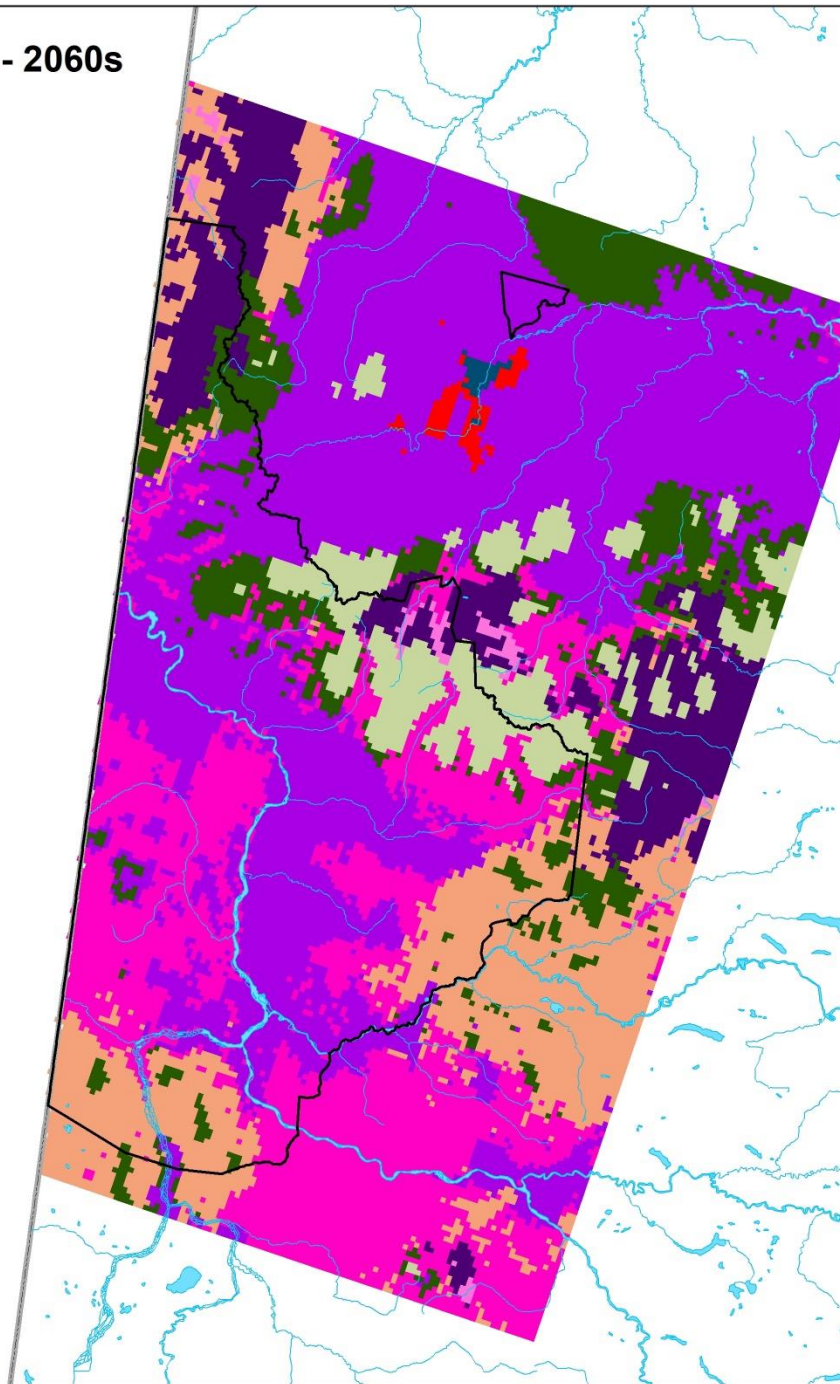
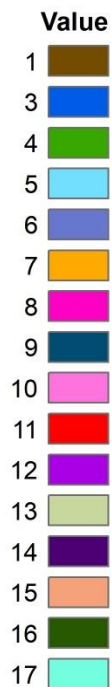
## CLIOMES - 2030s



## Highlights

- Original cliomes remaining: 8, 12, 13
- Cliome 9 (mixed boreal forest) is almost entirely lost in this scenario. Across all Yukon, cliome 9 predominantly occurs in northern Yukon in this time step
- Cliome 12 (more densely forested closed-canopy boreal) is projected to dominate in this time step.
- Cliome 12 incursion upslope into areas previously dominated by cliome 13 (sparsely vegetated boreal with elevation influences)
- Increasing coverage by cliome 8 (dry boreal wooded grasslands-mixed coniferous forests and grasses).
- Also, 2 new cliomes, although with relatively limited distribution; both reflect southern boreal forests: 15 (southern boreal/aspen parkland) and 16 (southern boreal, mixed forest).

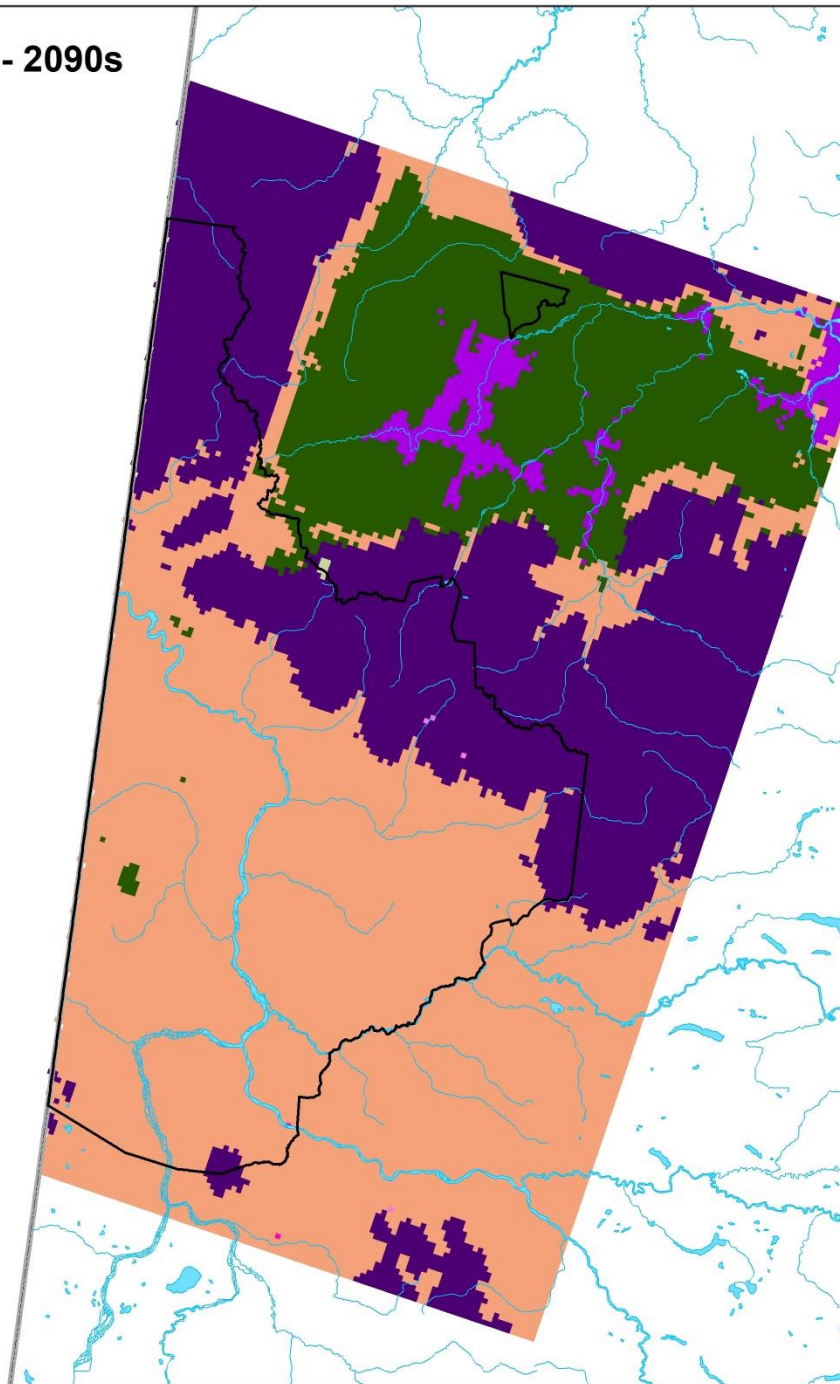
## CLIOMES - 2060s



## Highlights

- Original cliomes remaining: 8, 12, 13,
- Cliome 8 (*dry boreal wooded grasslands-mixed coniferous forests and grasses*) expanded coverage (perhaps 25% of total area?)
- Retraction of cliome 12 (more densely forested closed-canopy boreal), which had expanded in previous time step.
- Further retraction of cliome 13 (sparsely vegetated boreal with elevation influences); lower elevations of Ogilvie Mtns now dominated by more southern boreal forest types: cliome 12 and cliome 16 (southern boreal, mixed forest)
- Cliome 15 (southern boreal/aspen parkland), which was novel in previous time-step, expands along south, east, and north boundary
- Another novel cliome that represents southern boreal forest: cliome 14 (densely forested southern boreal)

## CLIOMES - 2090s

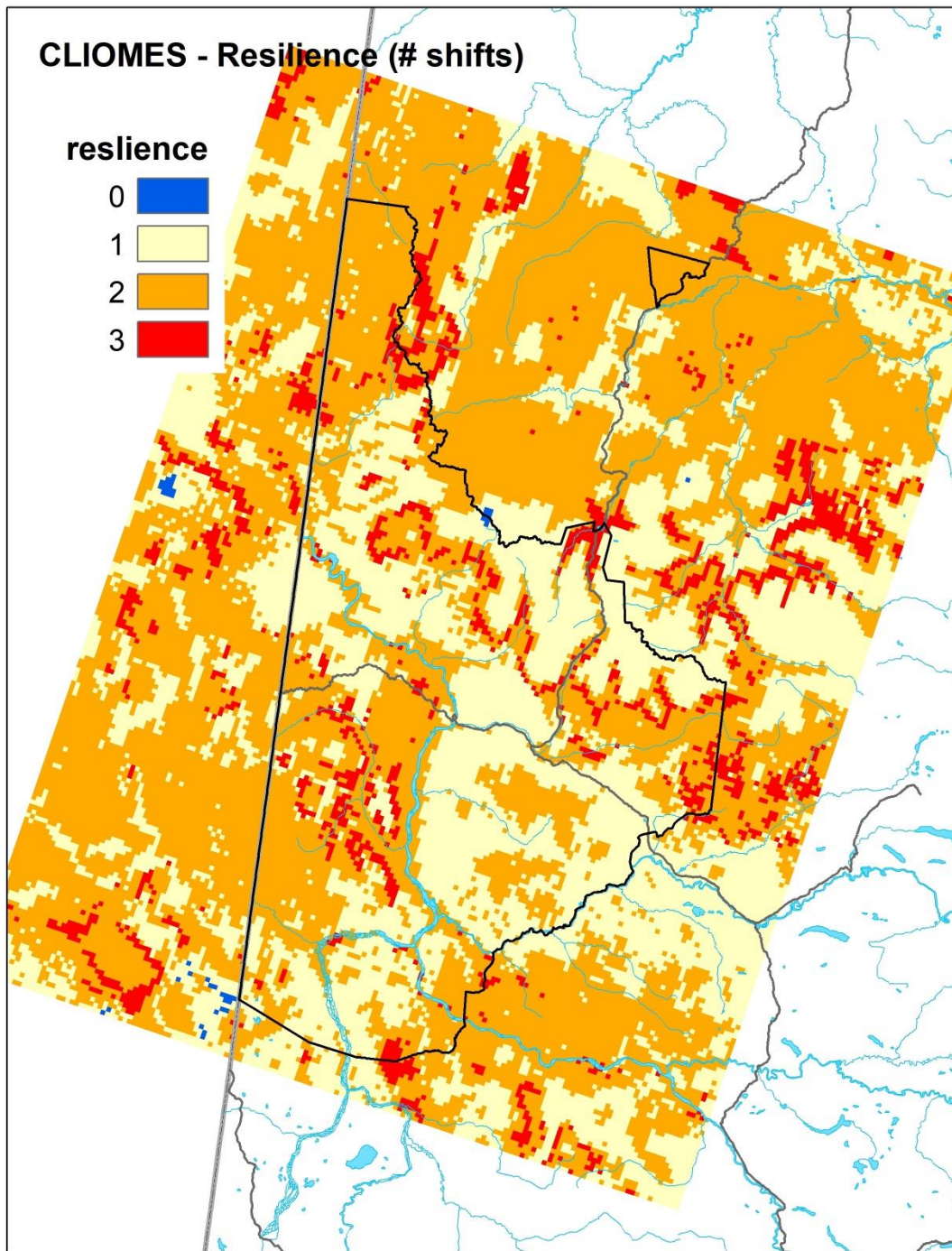
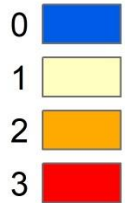


## Highlights

- Original cliomes remaining: none
- Region is dominated by southern mixed boreal forest and aspen parkland
- (Note, apparent simplification of cliomes at this time step may reflect in part the modelling resolution for the southern cliomes)

## CLIOMES - Resilience (# shifts)

### resilience



## Highlights

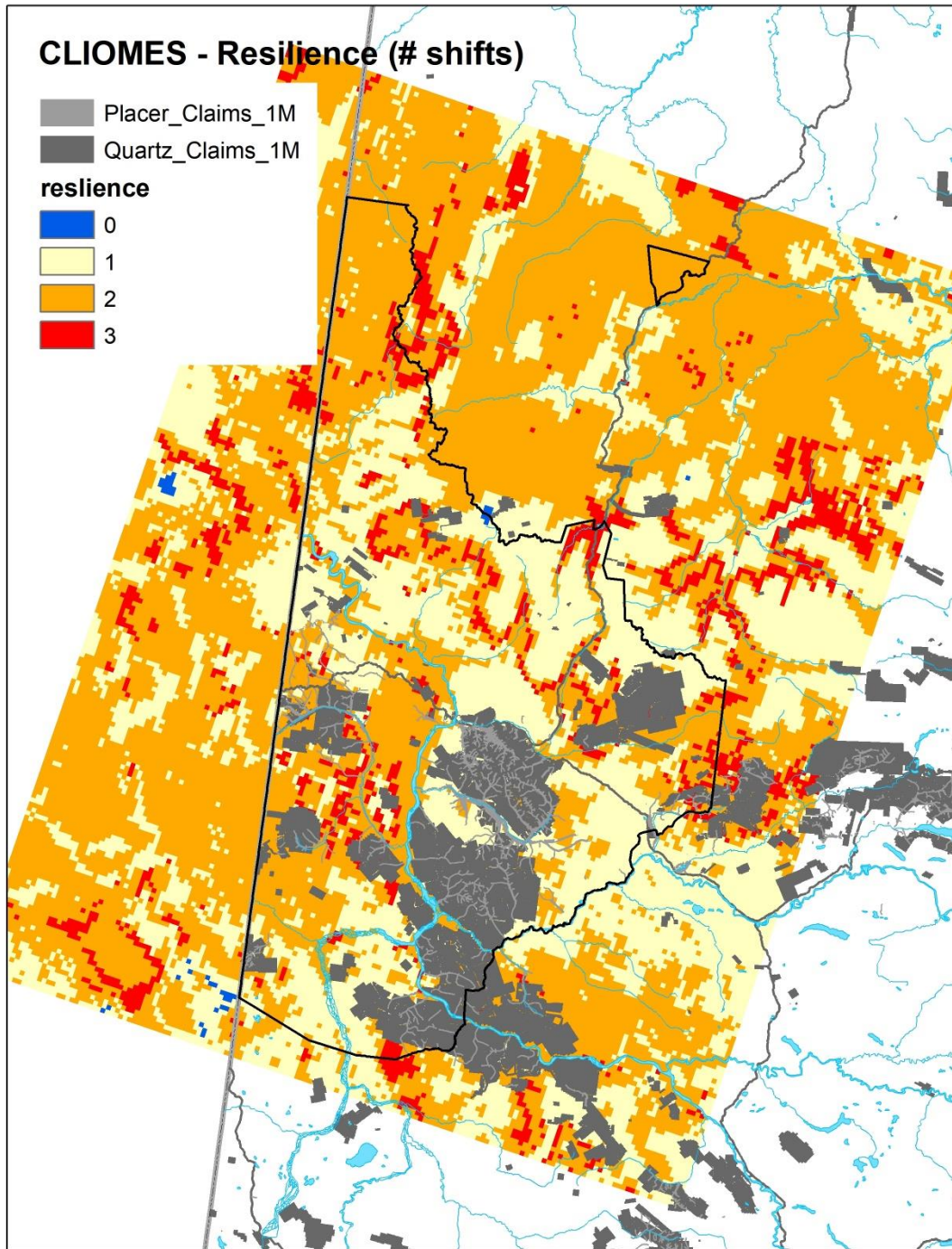
- Interestingly, despite the complete turnover in cliomes by the end of the century, many areas only experience one shift: from 12 (more densely forested closed-canopy boreal) to 15 (southern boreal/aspens parkland)
- Also of interest is the holdout of cliome 13 (sparsely vegetated boreal with elevation influences) at the highest elevations in Oglivie Mtns until the last time-step when it converts to 14 (densely forested southern boreal). These areas should be treated as refugia.
- There are no consistent shift patterns among areas with 2 shifts: e.g. from 12 to 8 to 15 in southwest *versus* 12 to 15 to 14 or 8 to 15 to 14 in north)
- Generally, shifts are among different boreal forest types, except for at the end of the century when projected climate for the southern half of the planning region is comparable to that associated with the aspen parkland regions of central AB & SK

## CLIOMES - Resilience (# shifts)

Placer\_Claims\_1M  
Quartz\_Claims\_1M

### resilience

0  
1  
2  
3



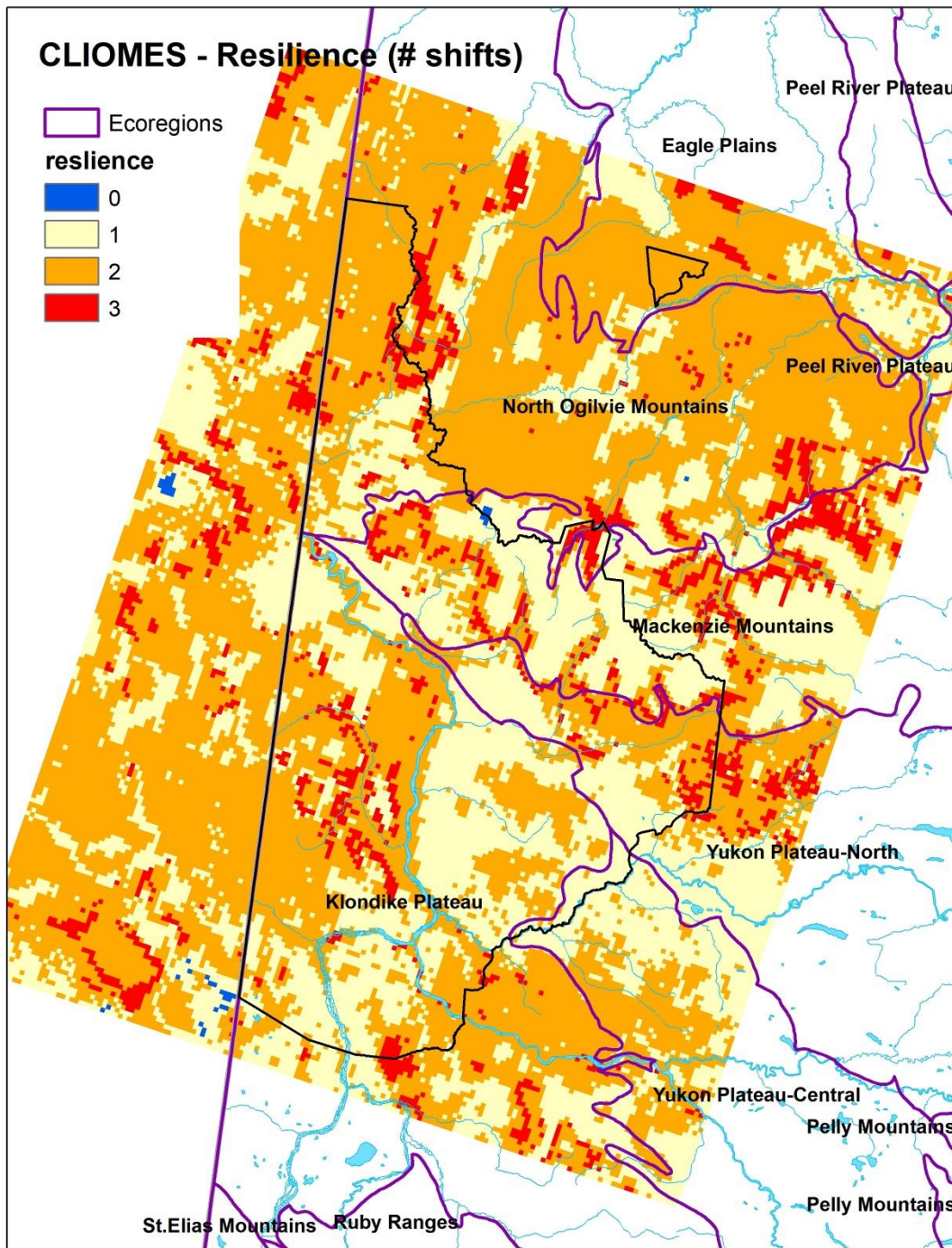
## Highlights

- Some of the most resilient areas in the Klondyke Plateau are heavily staked with quartz and placer claims
- Resilient and potential refugial areas in the Ogilvie Mountains do not currently have extensive staking.
- Claim data download – November 18, 2019

# CLIOMES - Resilience (# shifts)

Ecoregions

resilience



## Highlights