

US EPA ARCHIVE DOCUMENT

WRIA 1 SALMON RECOVERY: Strategies and Restoration Actions

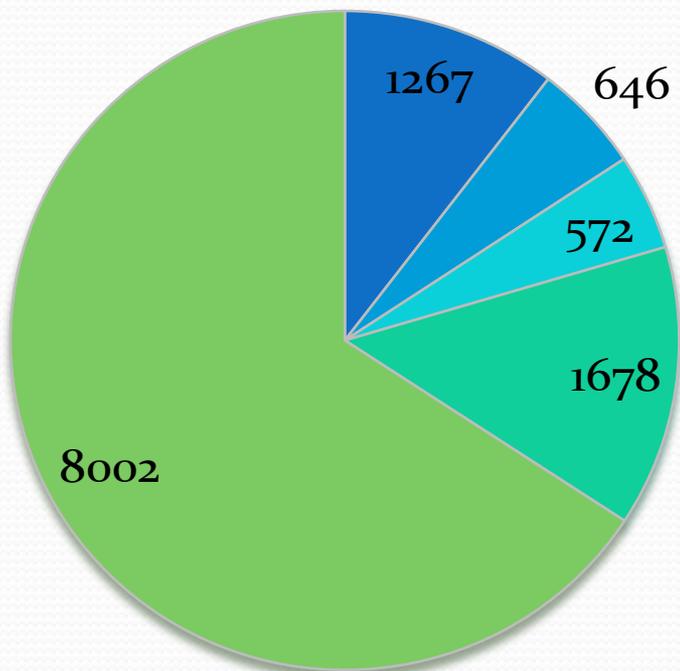
Treva Coe, Habitat Program Manager
Nooksack Tribe

WRIA 1 Climate Change Workshop, January 2013

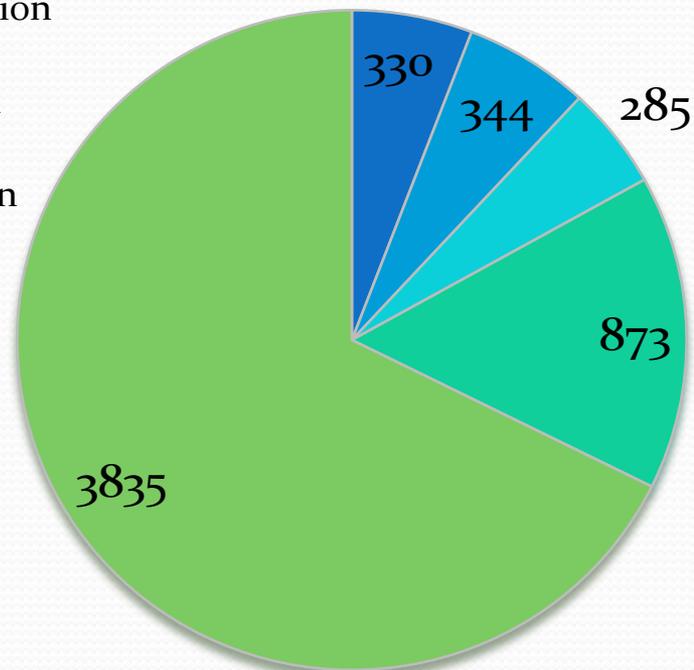
GENERAL HABITAT PRIORITIES

- Protection
- Nearshore Restoration
- Estuary Restoration
- Lower Nooksack Restoration
- Forks Restoration

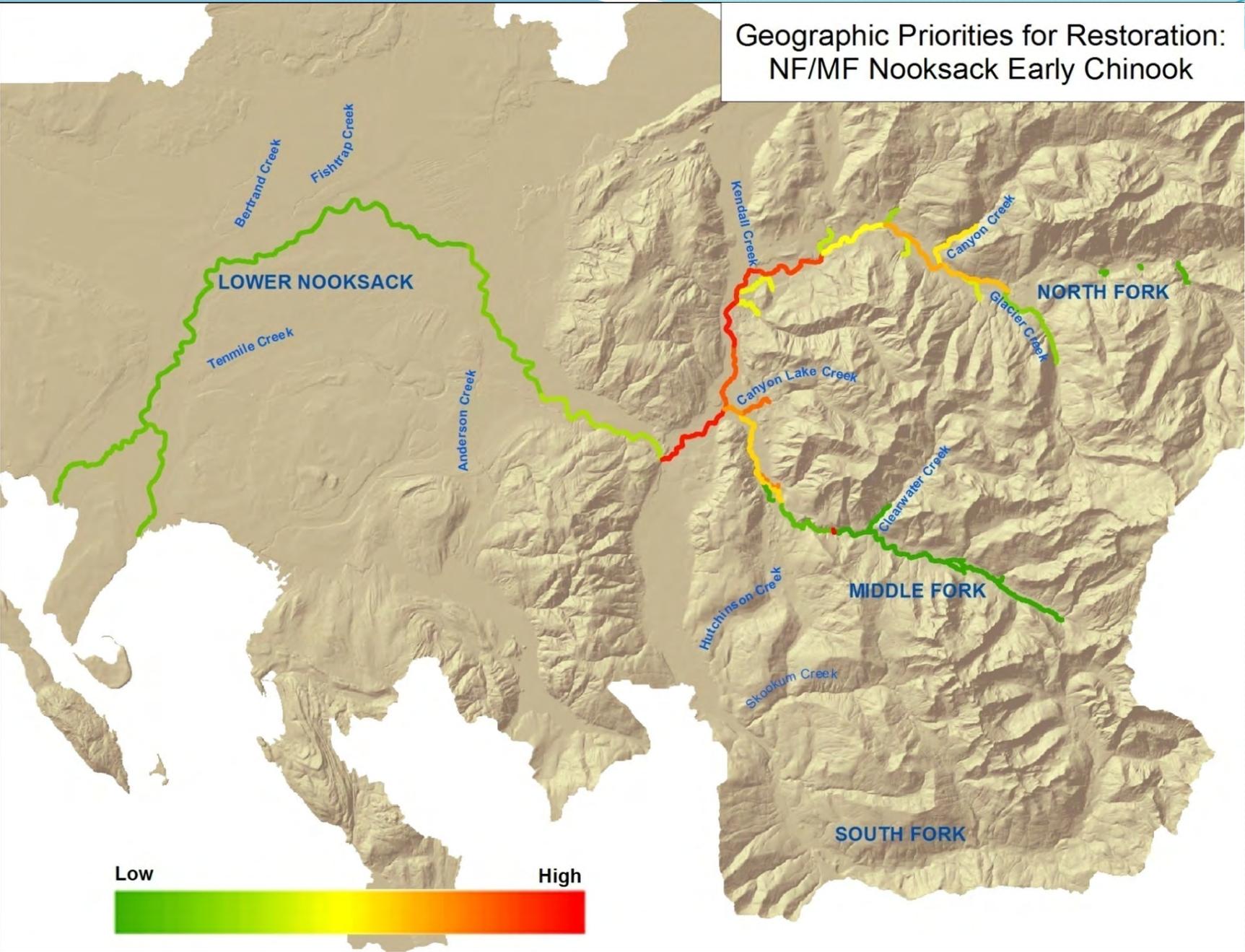
NF/MF



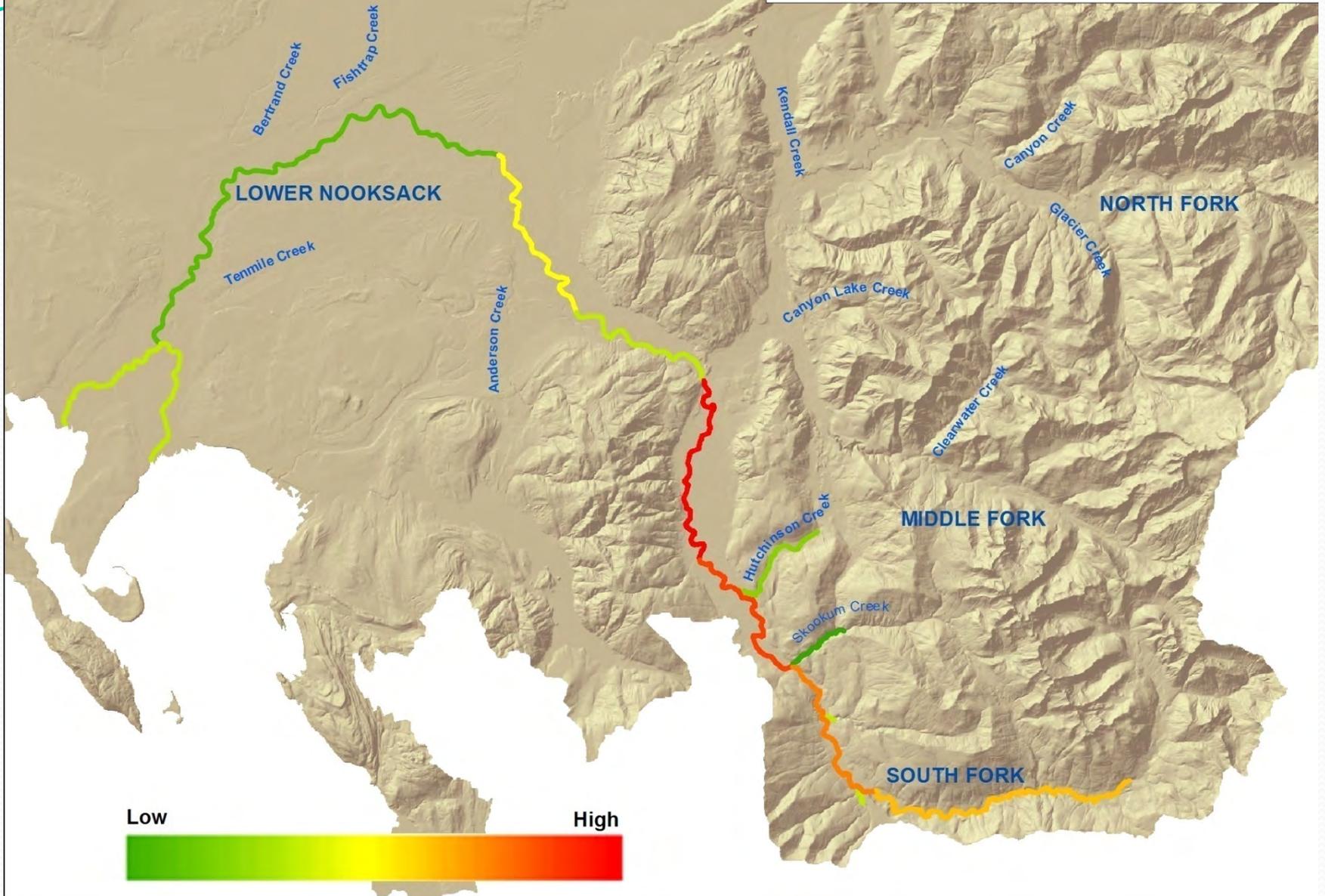
SF



Geographic Priorities for Restoration: NF/MF Nooksack Early Chinook



Geographic Priorities for Restoration: SF Nooksack Early Chinook

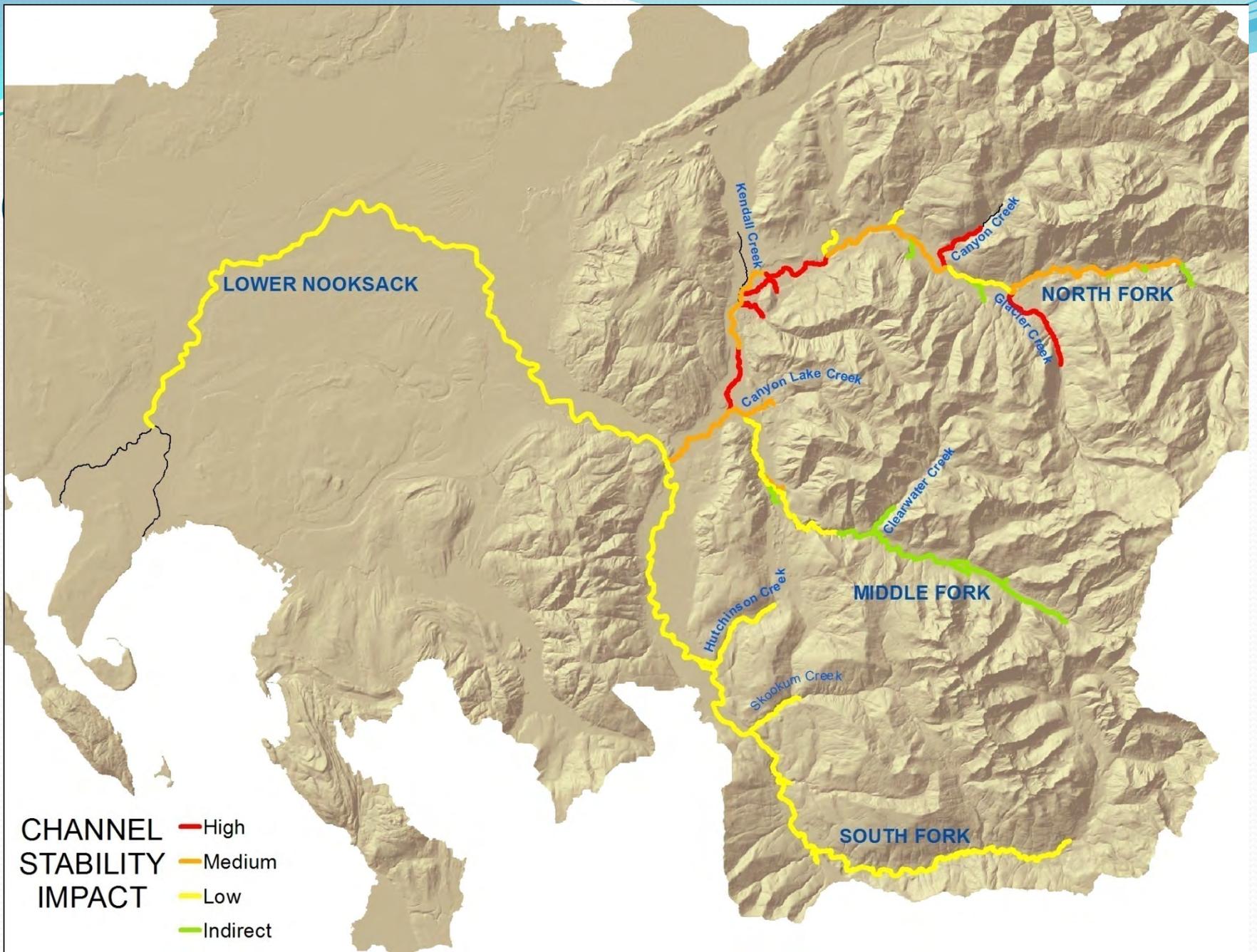


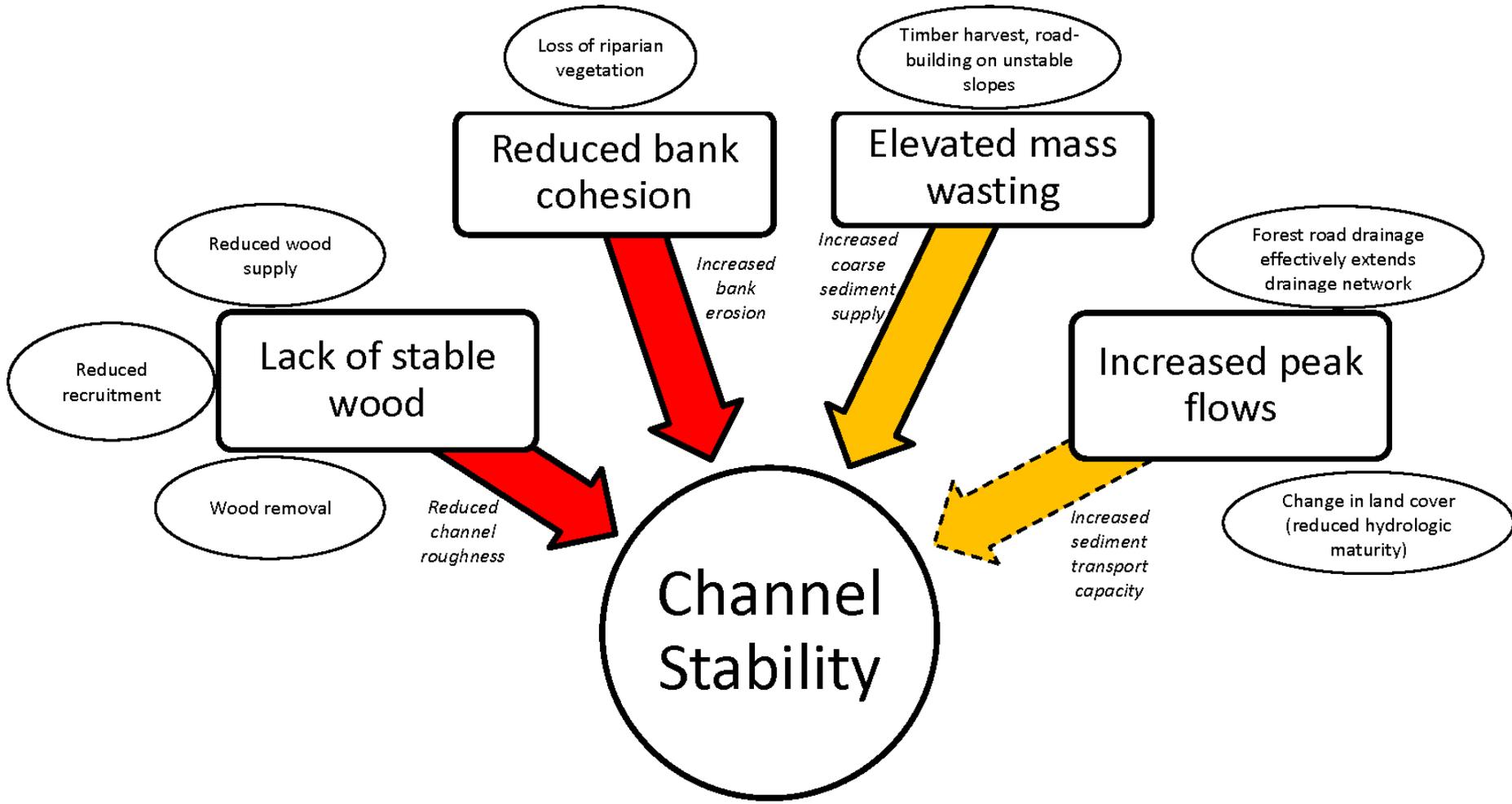
LIMITING FACTORS

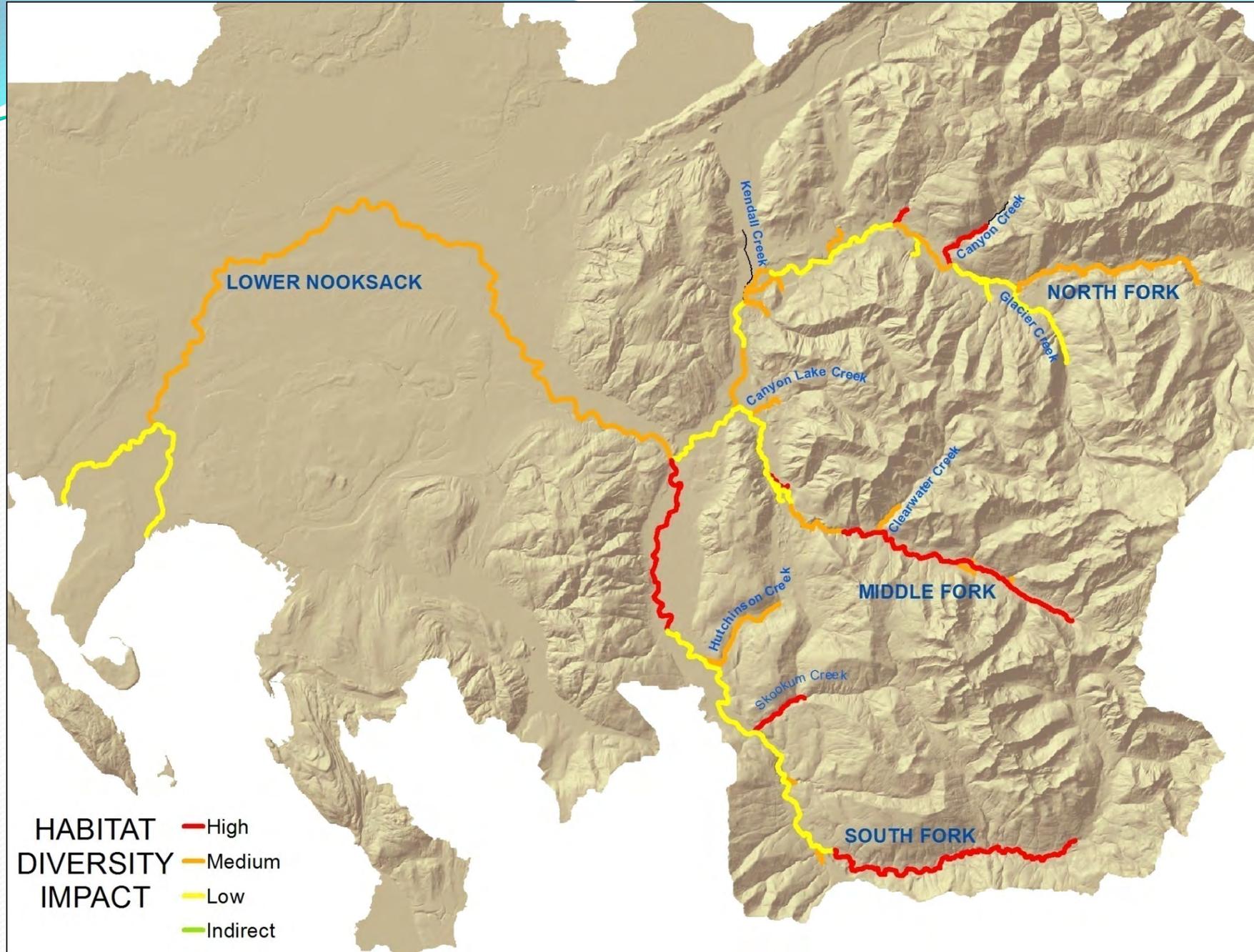
- Channel Stability
- Habitat Diversity
- Key Habitat Quantity
- Sediment Load
- Obstructions
- Withdrawals

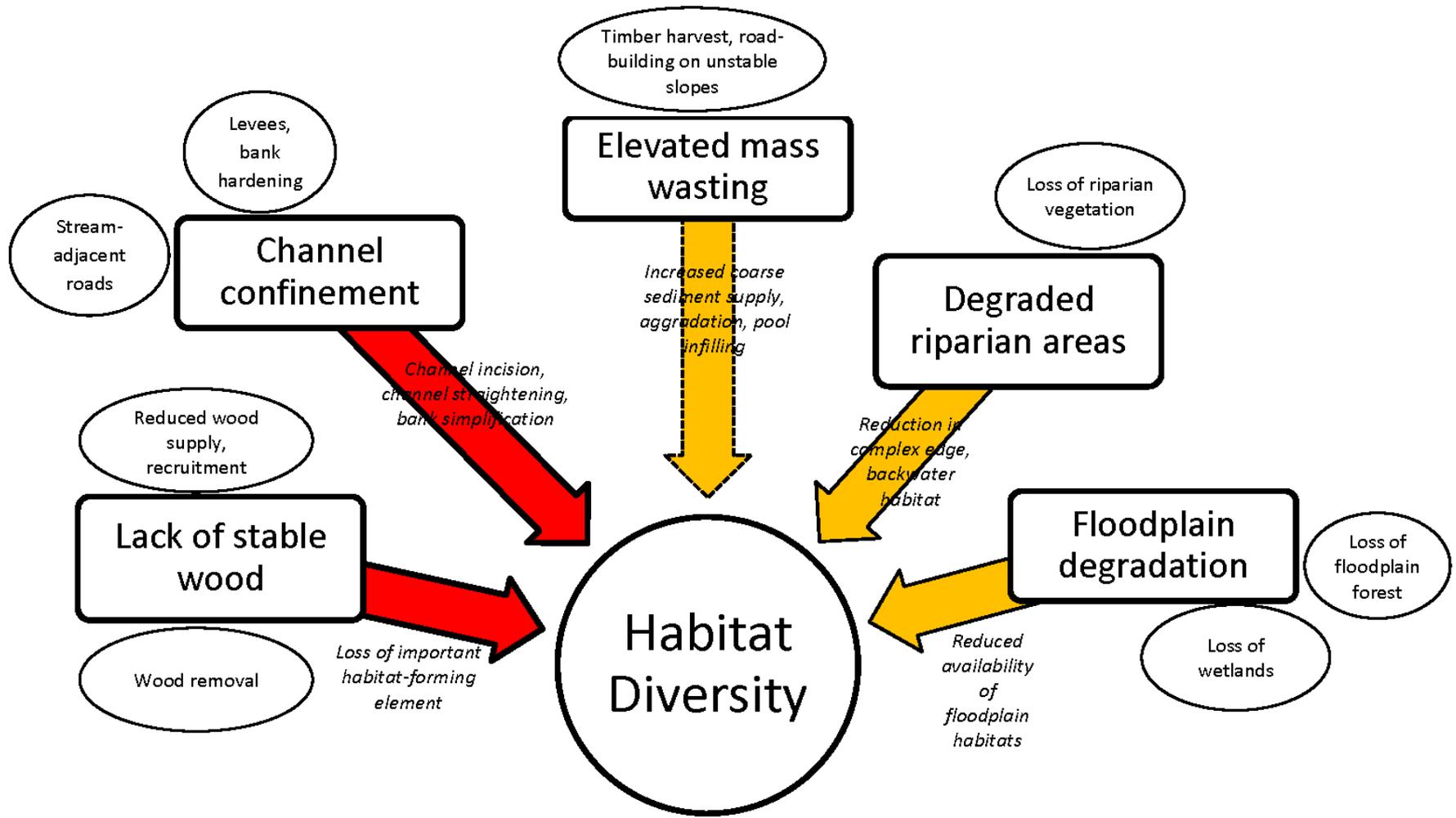
 • Flow

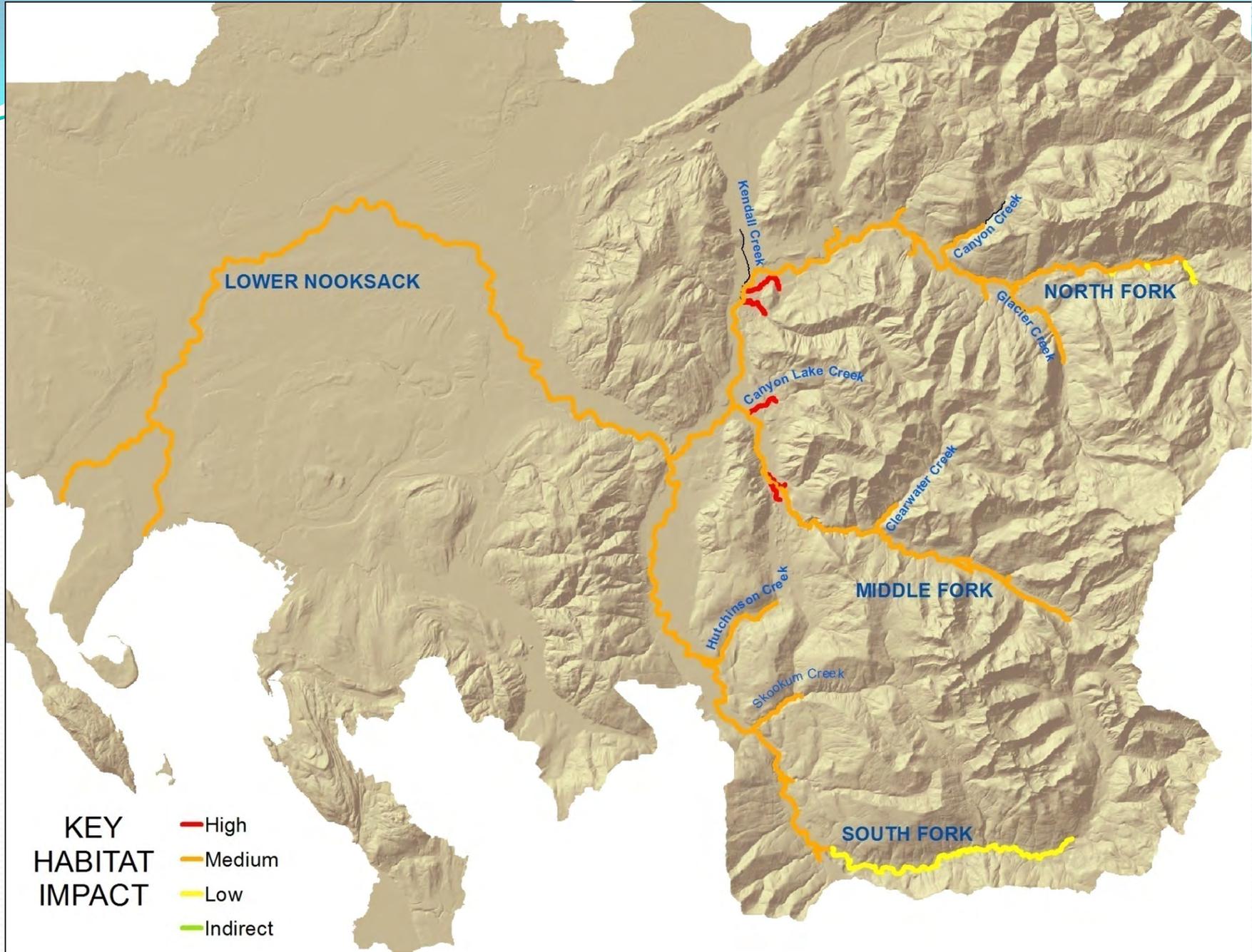
 • Temperature

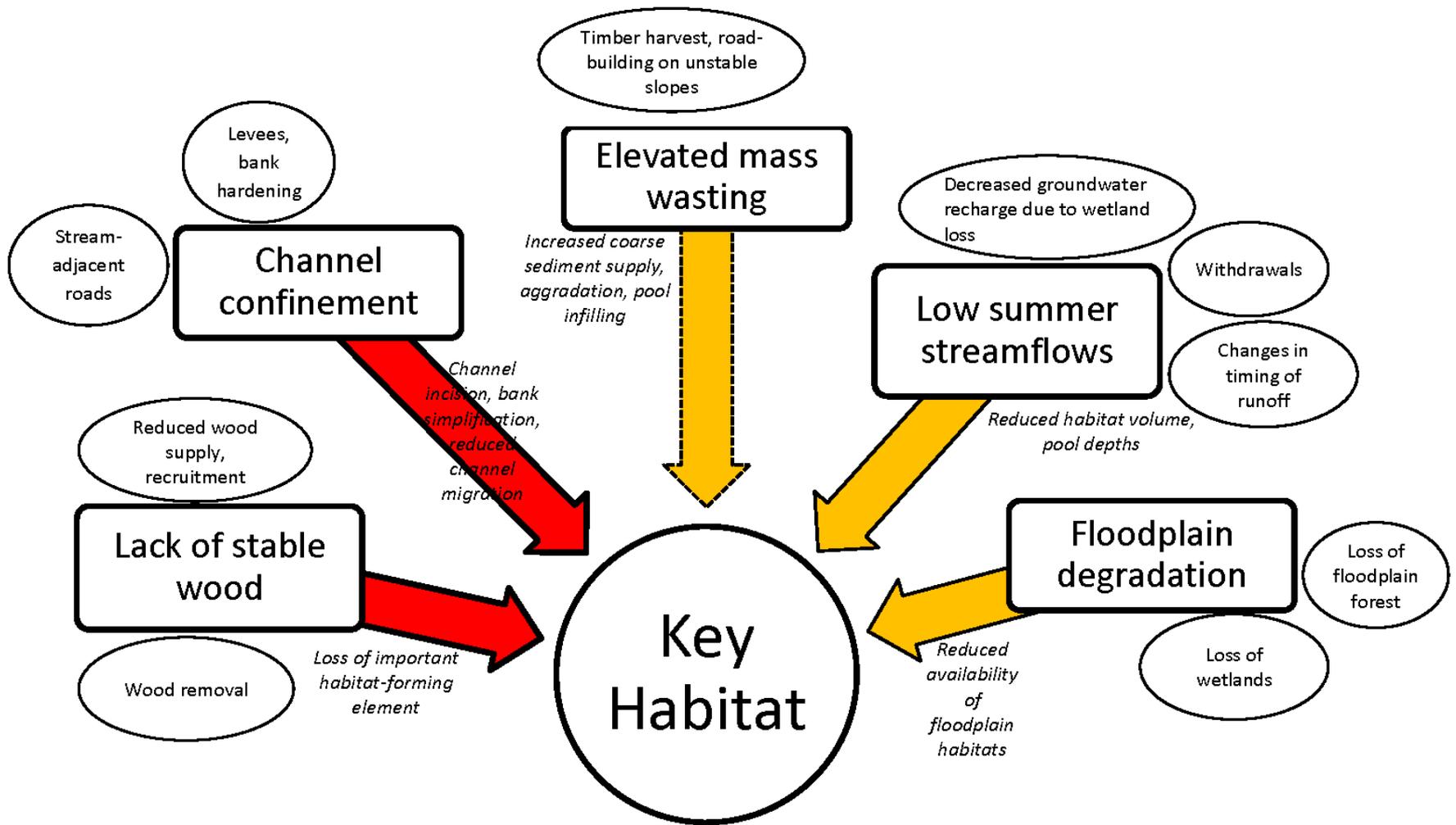


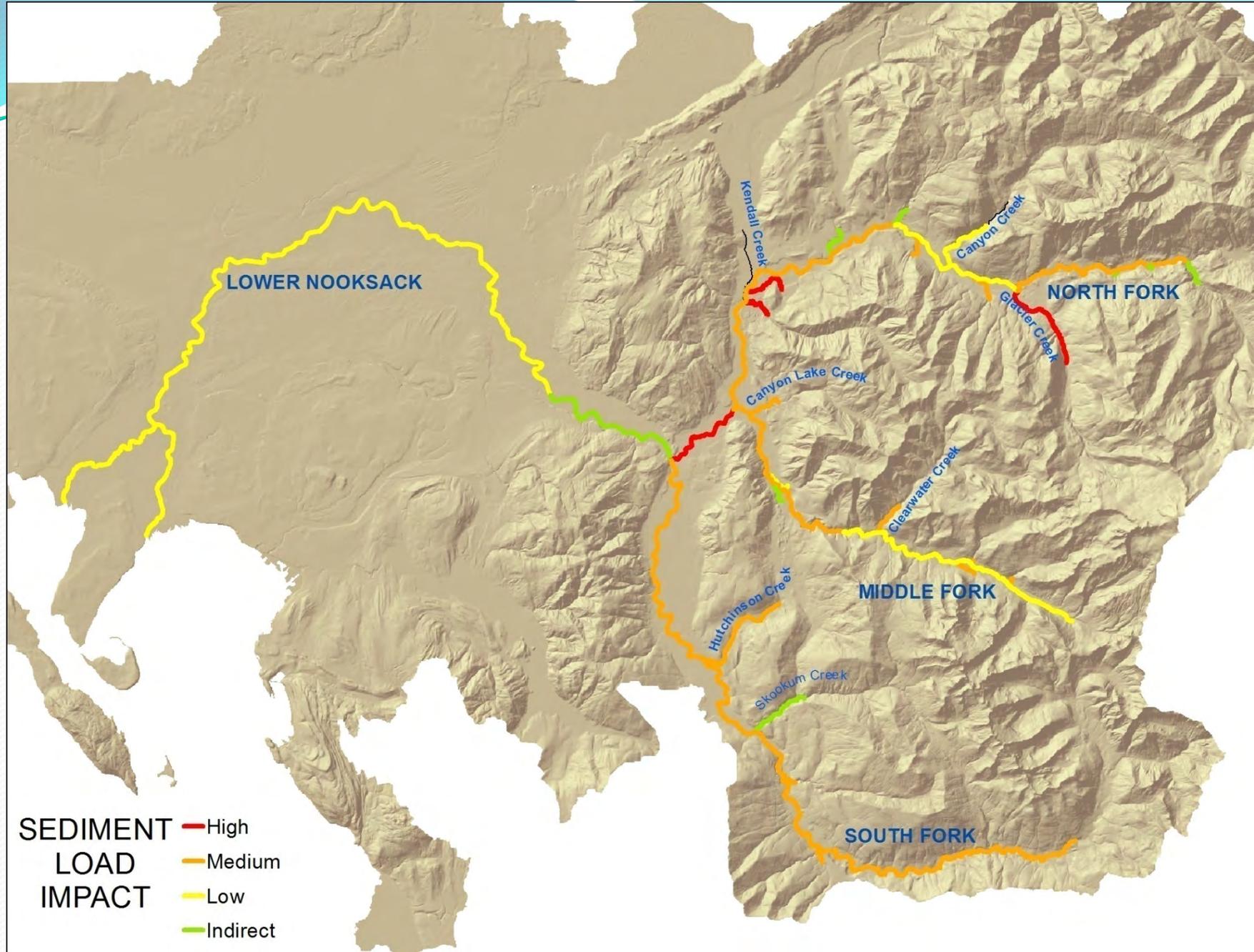






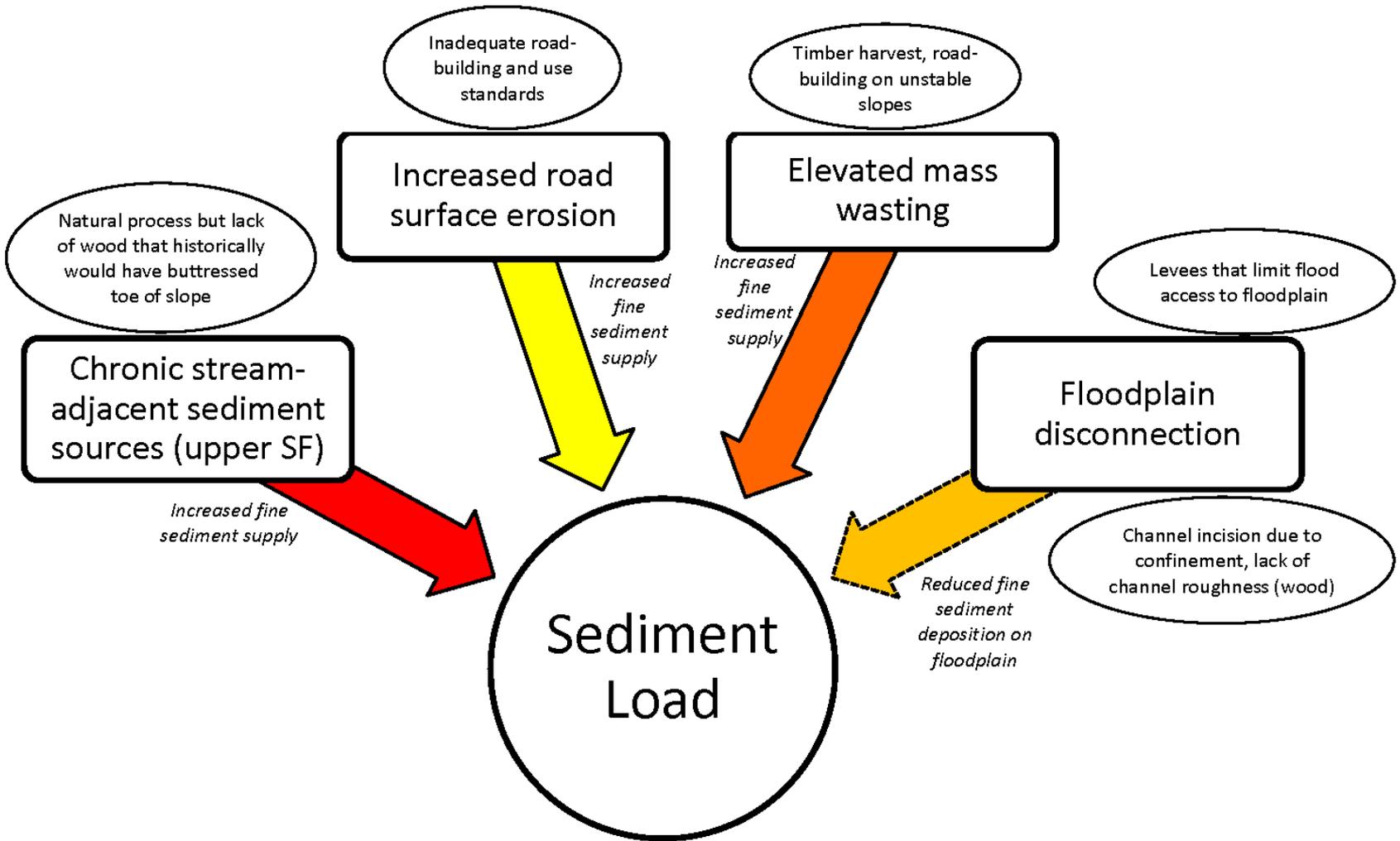


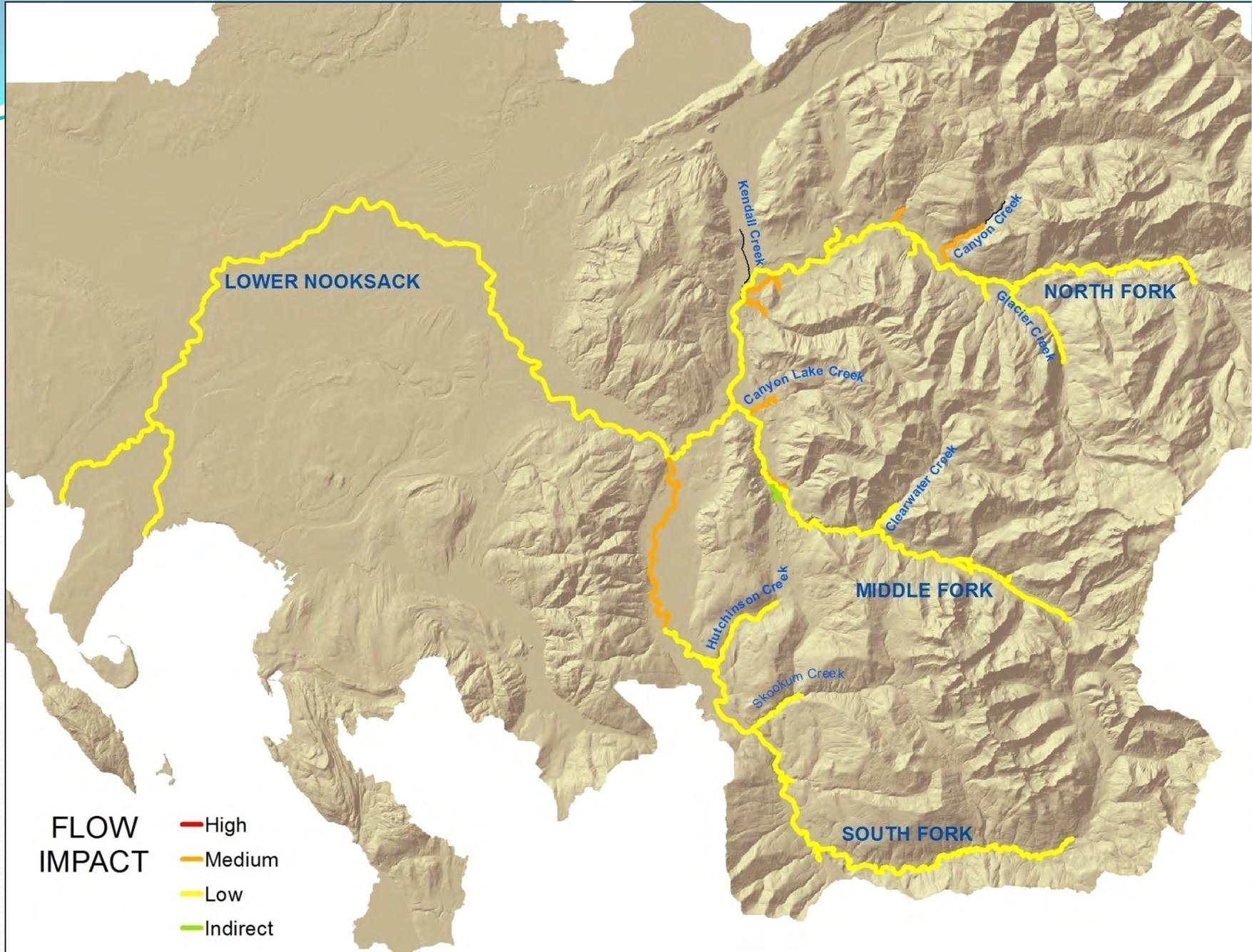




SEDIMENT LOAD IMPACT

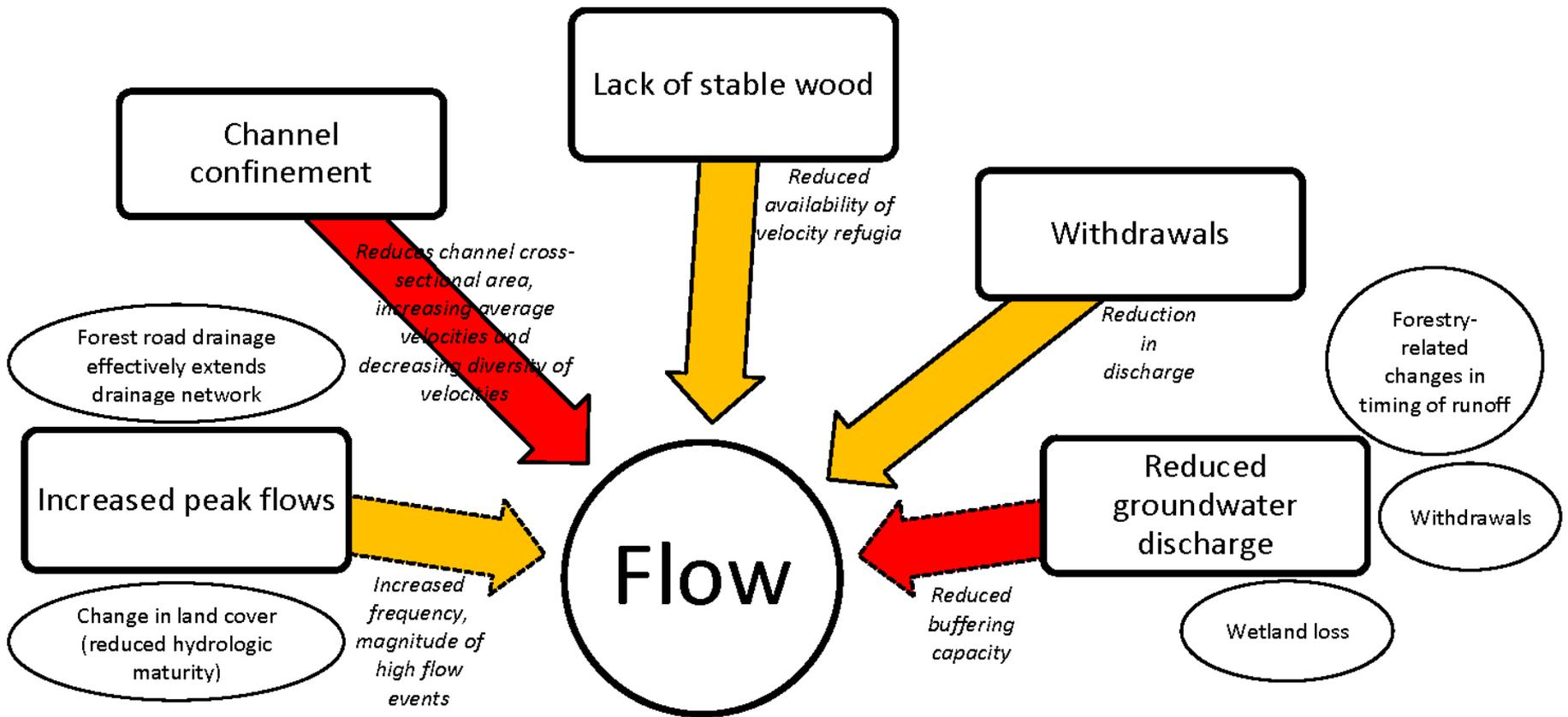
- High
- Medium
- Low
- Indirect

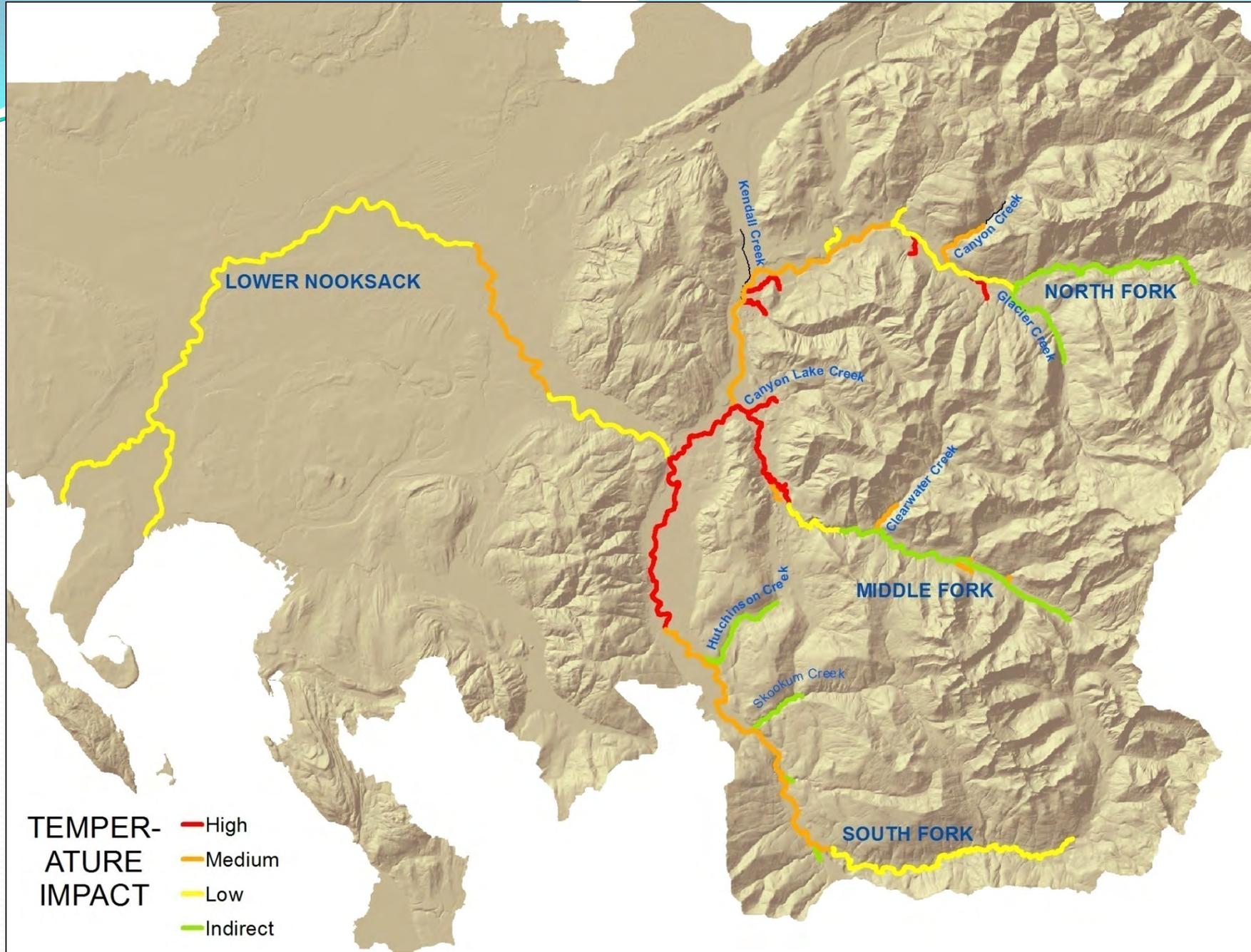


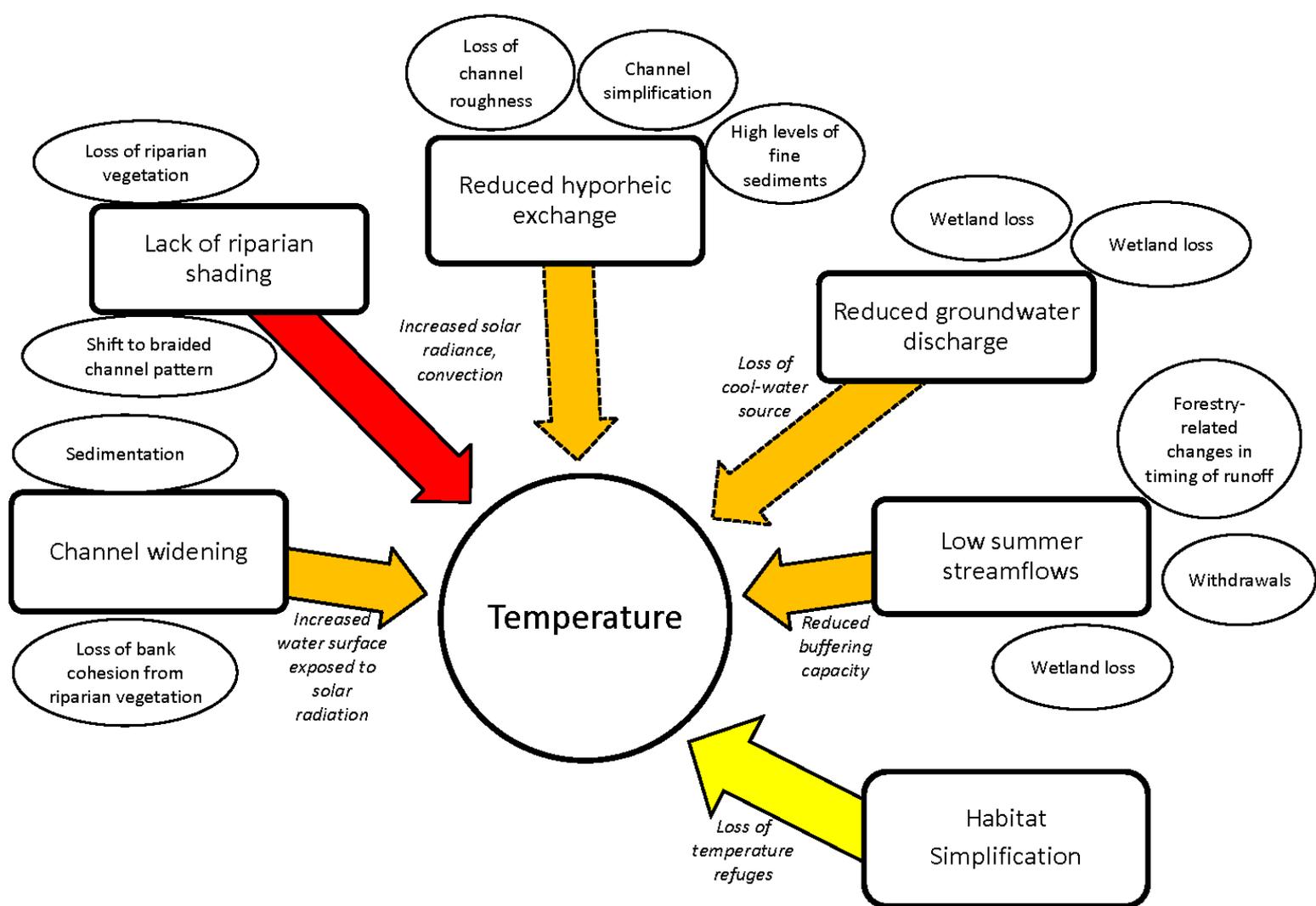


**FLOW
IMPACT**

- High
- Medium
- Low
- Indirect







Certainty of impact: Moderate to High (depending on availability of temperature data in area of interest)

- 303(d) listings for temperature for South Fork, Middle Fork, Racehorse, Boulder, Canyon, Cornell, Canyon Lake Creeks
- Temperature data, where available and depending on location, indicate frequent exceedances of water quality standards and optimal temperature ranges for various chinook life stages (especially in South Fork).

Actions

Limiting Factor

- Problem
- Reach-Scale
 - Objective
 - Direct Actions
 - Indirect Actions
- Subbasin-Scale
 - Objective
 - Direct Actions
 - Indirect Actions

Table C-5. Impacts of different project types on limiting factors. Where actions are similar between reach- and subbasin-scale, the difference is in the scale at which the actions are implemented.

Limiting Factor	Problem(s)	Reach-scale Actions			Subbasin-scale projects		
		Objective(s)	Direct	Indirect	Objective(s)	Direct	Indirect
Channel stability (including delivery and routing of coarse sediment)	High bed shear stress causes bed scour; low spatial variation of bed shear stress reduces availability of refugia; increased erodibility of stream banks due to loss of root cohesion and bank roughness.	Increase channel roughness through increased wood loading and bedform diversity; reduce artificial channel confinement; increase diversity of channel pattern; increase availability and connectivity of refugia (more stable habitats)	Place wood jams; remove or setback levees or riprap; restore or encourage formation of floodplain channels (especially side channels)	Restore degraded riparian zones by removing non-native vegetation and/or establishing native vegetation appropriate for habitat formation; reconnect channels to floodplain	Reduce anthropogenic sources of coarse sediment input by reducing mass-wasting potential; increase wood supply through improved riparian function in tributary watersheds; increase flood storage; improve LWD routing	Reduce frequency and magnitude of peak flows (see peak flows below).	Reduce road network through road abandonment or decommissioning; improve road network through culvert or stream crossing upgrades; improved road drainage; sidecast removal or reduction; restore degraded riparian zones in tributary watersheds; address impacts of channel constrictions (bridges, culverts) to wood routing.

UPPER SOUTH FORK	ACTIONS	Habitat diversity		Sediment load	Temperature		Key habitat quantity	ACTION IMPORTANCE
		Increase avail. of complex instream cover	Increase habitat unit diversity	Reduce fine sed. in gravels, reduce high turbidity	Decrease reach-scale temperature maxima	Increase availability, quality of temperature refuges	Increase quantity, quality of main channel pools, pool tailouts	
	Orphan road maintenance and abandonment	7		5			5	17
	Large-scale wood placement in areas of cool-water influence	10				7	7	24
	Large-scale wood placement in other areas	10					7	17
	Decrease river-adjacent sediment inputs to South Fork mainstem (e.g. roughen the toe of landslides)			7			5	12
	Riparian restoration along South Fork, important tribs for shading				7			7
	Riparian planting for wood recruitment in understocked channel migration areas.	10					7	17

RESTORATION STRATEGIES: NORTH FORK

		Reaches														
		38.3	40.6	42.9	43.7	46.7	49.4	49.8	50.6	51.1	52.3	53.3	54.8	55.8	57.8	61.9
North Fork	Construct/augment log jams to protect, encourage formation and growth of forested islands	Yellow	Yellow	Yellow	Green	Red	Red	Green	Red	Green	Red	Red	Red	Yellow	Green	Red
	Log jams to reconnect back channels	Green	Green	Green	Green	Red	Red	Green	Red	Green	Red	Red	Red	Yellow	Green	Red
	Logs/log jams to increase habitat quality in braids and back channels.	Green	Yellow	Yellow	Green	Yellow	Yellow	Green	Green	Green	Yellow	Yellow	Yellow	Green	Green	Yellow
	Reforest historic channel migration zone and 300' buffer	Yellow	Yellow	Yellow	Green	Yellow	Yellow	Green	Yellow	Green	Yellow	Yellow	Yellow	Yellow	Green	Yellow
	Promote floodplain forest encroachment on active channel area.	Yellow	Yellow	Green	Yellow	Red	Green	Yellow	Green	Yellow	Red	Yellow	Yellow	Yellow	Green	Yellow
	Promote channel-floodplain interaction to restore floodplain processes	Green	Green	Green	Green	Yellow	Green	Yellow	Green							
	Acquire properties necessary for restoration	Green	Yellow	Green	Red	Green	Green									
	Acquire properties at risk of degradation	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red	Red	Red	Yellow	Yellow	Red	Red	Yellow
Early chinook tribs	Restore riparian areas	White	White	White	Yellow	White	White	Yellow	White	Green	White	Green	Yellow	Green	White	Green
	Restore habitat (diversity, stability)	White	White	White	Yellow	White	White	Yellow	White	Green	White	Green	Yellow	Green	White	Green
	Restore fish passage	White	White	White	White	White	White	White	White	White	White	White	Red	Yellow	White	White
	Acquire properties at risk of degradation	White	White	White	Yellow	White	White	Green	White	Green	White	Green	Red	Green	White	White
Watershed	Assess, treat orphaned roads	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
	Address chronic sediment sources	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow

RESTORATION STRATEGIES: NORTH FORK

North Fork	Construct/augment log jams to protect, encourage formation and growth of forested islands
	Log jams to reconnect back channels
	Logs/log jams to increase habitat quality in braids and back channels.
	Reforest historic channel migration zone and 300' buffer
	Promote floodplain forest encroachment on active channel area.
	Promote channel-floodplain interaction to restore floodplain processes
	Acquire properties necessary for restoration
	Acquire properties at risk of degradation
Early chinook tribs	Restore riparian areas
	Restore habitat (diversity, stability)
	Restore fish passage
	Acquire properties at risk of degradation
Watershed	Assess, treat orphaned roads
	Address chronic sediment sources

Category	Temp	Base	Peak	Res
Barrier removal	Y	Y	N	Y
Floodplain reconnection	Y	N	Y	Y
Vertical connectivity	Y	Y	Y	Y
Stream flow regimes	Y	Y	N	Y/N
Sediment reduction	N	N	N	N
Riparian restoration	Y	N/Y	N	N
Instream rehabilitation	Y/N	N	N	N
Nutrient enrichment	N	N	N	N

RESTORATION STRATEGIES: MF

		Reaches							
		1.5	3.1	5.2	7.2	9.4	11.7	14.5	17.4
Middle Fork	Construct/augment log jams to protect, encourage formation and growth of forested islands	Red			Green				
	Log jams to reconnect back channels	Red			White	Yellow		Green	White
	Install engineered wood structures to increase roughness, improve channel stability, and slow migration	Red			White	Yellow	Green	White	Green
	Increase woody cover along channel edges	Red	Yellow		White	Green	Yellow	Green	White
	log jams to form deep complex pools	Red			White	Yellow	Green	White	Green
	Restore fish passage	White	Red	White					
	Reforest historic channel migration zone and 300' buffer	Yellow				White			
	Reconnect and restore floodplain wetlands	Green							
	Acquire properties necessary for restoration	Yellow		Green					White
	Acquire properties at risk of degradation	Green							
Early chinook tribs	Restore riparian areas	Green	White	Green	White	Yellow	White	Green	White
	Restore habitat (diversity, stability)	Green	White	Green	White	Yellow	White	Green	White
	Restore fish passage	White							
	Acquire properties at risk of degradation	Green	White	Yellow	White	Green			

RESTORATION STRATEGIES: MF

Middle Fork	Construct/augment log jams to protect, encourage formation and growth of forested islands
	Log jams to reconnect back channels
	Install engineered wood structures to increase roughness, improve channel stability, and slow migration
	Increase woody cover along channel edges
	log jams to form deep complex pools
	Restore fish passage
	Reforest historic channel migration zone and 300' buffer
	Reconnect and restore floodplain wetlands
	Acquire properties necessary for restoration
	Acquire properties at risk of degradation
Early chinook tribs	Restore riparian areas
	Restore habitat (diversity, stability)
	Restore fish passage
	Acquire properties at risk of degradation

Category	Temp	Base	Peak	Res
Barrier removal	Y	Y	N	Y
Floodplain reconnection	Y	N	Y	Y
Vertical connectivity	Y	Y	Y	Y
Stream flow regimes	Y	Y	N	Y/N
Sediment reduction	N	N	N	N
Riparian restoration	Y	N/Y	N	N
Instream rehabilitation	Y/N	N	N	N
Nutrient enrichment	N	N	N	N

RESTORATION STRATEGIES: SF

South Fork	Log jams to form deep pools: cool-water areas
	Log jams to form deep pools: other areas
	Replace riprap with wood bank structures
	Reconnect and restore side-channels
	Setback or remove riprap embankments
	Lower artificial levees to native elevations
	Relocate infrastructure outside EHA
	Reforest HMZ and 300' buffer
	Remove invasive species
	Reconnect floodplain channels
	Large wood placement in floodplain channels
	Riparian restoration along floodplain channels
	Acquire properties necessary for restoration
	Acquire properties at risk of degradation
Early chinook tribs	Restore riparian areas
	Restore habitat (diversity, stability)
	Restore fish passage
	Acquire properties at risk of degradation
Watershed	Assess, treat orphaned roads
	Address chronic sediment sources

Category	Temp	Base	Peak	Res
Barrier removal	Y	Y	N	Y
Floodplain reconnection	Y	N	Y	Y
Vertical connectivity	Y	Y	Y	Y
Stream flow regimes	Y	Y	N	Y/N
Sediment reduction	N	N	N	N
Riparian restoration	Y	N/Y	N	N
Instream rehabilitation	Y/N	N	N	N
Nutrient enrichment	N	N	N	N