

Resource Analysis

Step #1 for an Ecosystem-based Conservation Action Framework for Slocan Lake

for
Slocan Lake Stewardship Society



by
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Executive Summary

The Slocan Lake Stewardship Society (SLSS) is developing an Ecosystem-based Conservation Action Framework in order to guide priorities for stewardship, conservation and education efforts in the Slocan Lake ecosystem over the next five years (2016-2021). The purpose of this Resource Analysis (step 1) is to ask scientists currently working in the watershed to identify valuable ecosystem assets, and to suggest priorities and directions for a Science Forum (step 2), planned for early summer 2016.

This Resource Analysis relied upon expert opinion and interpretation of the Slocan Lake Watershed. The author designed a 16-question interview (Appendix A) and from September 30 through to October 29, 2015, interviewed 11 science professionals from a broad range of scientific disciplines who are familiar with the Slocan Lake region.

All of the science experts agreed that taking a watershed approach to defining the Slocan Lake Ecosystem is an appropriate way of organizing and talking about the landscape; however, some advised going beyond the watershed boundaries to include the full home range of wide-ranging wildlife species where necessary. The experts identified important ecological attributes of this ecosystem summarized under the following five themes: relatively intact; biologically rich; big enough to sustain healthy populations and ecological functions; low productivity; and fragmented. The latter two themes do not necessarily contradict the others. In this large landscape contrary forces coexist. The range of descriptions provided by the experts further defines the qualities and values of this diverse ecosystem.

The scientists described their research in the Slocan Lake Ecosystem as addressing over-arching themes of: 1) *monitoring population trends* (for example, of bats, bull trout, western toads and wolverine); 2) *conserving habitat* (for example, fish spawning areas, wetlands and old growth forests); 3) *protecting native biodiversity* (for example, by preventing introductions of new invasive species, and containing already established ones); and 4) *preparing for climate change impacts* (for example, by developing predictions and potential future scenarios to help manage for risks).

The experts identified four significant threats to the Slocan Lake Ecosystem: 1) invasive species, 2) direct loss of habitat, 3) recreational pressure, and 4) uncertainty of climate change impacts. According to these experts, there are five main areas where SLSS and its partners can focus their activities to make a significant, positive difference in the Slocan Lake Ecosystem.

- ✓ Prevent & Control Invasive Species
- ✓ Protect Existing Habitat
- ✓ Enhance Connectivity & Corridors
- ✓ Reduce Recreational Pressure
- ✓ Advance Climate Resilience through Mitigation & Adaption

All of the experts agreed the Slocan Lake Stewardship Society has an important role to play in protecting this ecosystem. The experts highlighted many examples of effective strategies, practices and initiatives in order to inform SLSS's approach to addressing environmental issues. Seven key themes emerged to help organize their recommendations for SLSS's activities:

1. Lead with science
2. Volunteer organizing
3. Education
4. Advocacy
5. Conservation, enhancement & restoration
6. Relationship & partnership development
7. Regional conservation capacity-building

The next step following this Resource Analysis is a day-long Science Forum in early summer 2016. The Science Forum is intended to get science experts and land and water stewards around the same table to think systematically about the future of the Slocan Lake Ecosystem. The Forum will include presentations, small group strategy sessions, and full-group discussion and priority-setting that will result in *The State of the Slocan Lake Watershed* report. This report will form the basis for SLSS's Ecosystem-based Conservation Action Framework for 2016-2021.



Purpose

The Slocan Lake Stewardship Society (SLSS) is developing an Ecosystem-based Conservation Action Framework in order to guide priorities for stewardship, conservation and education efforts in the Slocan Lake ecosystem over the next five years (2016-2021). Taking an ecosystem-based approach allows SLSS to consider conservation opportunities beyond Slocan Lake and the foreshore by encompassing a larger geographic area that takes in account ecological connectivity across the landscape. By taking a broader geographic scope, SLSS will also broaden opportunities for partnerships and joint projects.

The purpose of this Resource Analysis (step 1) is to ask researchers currently working in the watershed to identify valuable ecosystem assets, and to suggest priorities and directions for the second step, a Science Forum, planned for early summer 2016. Together, these two processes will build a strong scientific foundation for SLSS's Conservation Action Framework.

The resource information contained in this report focuses on key attributes of the Slocan Lake Watershed's biological diversity and overall ecology. The analysis specifies protection for focal / target species, habitats and processes; identifies pressing ecological threats to the ecosystem; and prioritizes strategies and actions for stewardship and conservation.

Methods

The Resource Analysis relied upon expert science opinion and interpretation of the Slocan Lake Watershed. The author designed a 16-question interview (Appendix A) and from September 30 through to October 29, 2015, interviewed 11 science professionals from a broad range of scientific disciplines who are familiar with the Slocan Lake region (Appendix B). Their perspectives and recommendations are grounded in decades of collective scientific expertise and dedication to conserving fish and wildlife.

The organization of this report follows the questions and responses provided during the interviews. The sections are: A) description of the Slocan Lake Watershed; B) boundaries of the Slocan Lake ecosystem; C) key attributes and indicator species of the ecosystem; D) threats and stressors to the ecosystem; E) effective strategies to manage threats and stressors; and recommendations for what actions would make the biggest difference; F) suggestions for strengthening SLSS's Conservation Action Framework; G) ideas for SLSS's role in advancing and supporting scientific research and conservation efforts; H) recommendations for moving forward with a Science Forum; and I) alignment with other organizations and action plans. Refer to Appendix C for a summary of available and accessible data sources. Refer to Appendix D for emerging issues identified during the interviews.



FINDINGS

A. Description of the Slocan Lake Watershed

When the experts were asked to describe the Slocan Lake Watershed, a lovely and rich mosaic of qualities emerged from their responses. In their words,

Slocan Lake Ecosystem is ... *Wild waters – magical – where forest meets water – once the coastal edge of North America – wet, very wet – world class rainforest ecosystem – biologically rich – Slocan Lake, a jewel at its center – velvety water – a unique large lake in the Columbia Basin – a ‘real’ lake, not directly influenced by dams – not managed like Arrow and Kootenay lakes – kokanee runs up Bonanza, Silverton, Wilson, Carpenter – a special place in my heart – a positive place – diverse from lowest trophic levels up – cold water systems – steep rocky mountain sides, narrow valleys – pristine, relatively intact – a refugia for native species – not heavily populated – vocal ecosystem guardians – people who care about each other and the environment – no big industries or point source pollution – shy harlequin ducks way up drainages – premier bull trout spawning habitat in Silverton Creek – toads crossing roads – long-eared bats congregate along the Rail Trail to drink still water in marshes – loss of habitat affecting loss of species – dense, closed coniferous forests – a place to harvest – big forestry in back ends of drainages – suffered landscape but recovering in places – clearcuts, avalanches and landslides provide openings in canopy for birds – openings warm up creek water – no Forest Practices Code in effect – can the forest withstand a third cutting? – how much old growth is left? – this watershed is lucky – big wilderness in Valhalla Provincial Park on west side – spectacular – stunning views – Valhallas, an island of mountains – creates its own weather – you know you are in a Park – a reminder of how much we have taken from the larger landscape – rugged and remote – wolverine tracks across Cove Creek – what’s not in Valhalla and Goat Range Parks is hanging on, but not caribou – primeval swamps of big cedars & skunk cabbage – wetlands have it all – only 2% is wetland and riparian habitat – precious refuges, every bit counts – old mines are now some of the best hibernacula – let’s hold on to what we have – where are the connections? – where is it fragmenting? cut off? – at risk for invasion by northern pike, zebra and quagga mussels, bullfrogs, Eurasian milfoil, white-nose syndrome – lack of glacial fed streams, decreasing snow pack – a place in transition – a new climate is changing everything.*

B. Boundaries of the Ecosystem

SLSS is taking an ecosystem-level approach to its work by choosing to use hydrologic boundaries based on the height of land of surrounding mountain ranges and associated sub-watersheds to delineate the Slocan Lake Ecosystem. The entire catchment area including Slocan Lake is 183,026 hectares, of which approximately 176,113 hectares (96%) is the land area. All of the science experts agreed that defining the ecosystem based on watersheds is reasonable and workable. Watersheds are a good way of organizing and talking about the landscape, and as one person noted, “Watersheds are the way to go, it’s actually how we see this landscape.”

A hydrologic perspective clearly works for addressing aquatic systems, fisheries and amphibians. Some bird species also use and benefit seasonally from elevational gradients within sub-watersheds.

However, watershed boundaries may not be as relevant for wide-ranging bird species and mammals such as grizzly bear, wolverine, wolf, lynx, cougar, elk and caribou. It was suggested that separating the Slocan Lake Watershed from the larger regional context would be a mistake for two reasons related to connectivity. How this valley connects to the greater Slocan River valley and other adjacent valleys for movement of wide-ranging species has both positive and negative consequences. On the positive side, connectivity is critical for wide-ranging large mammals that move between the Little Slocan Lakes area and Valhalla Park, and Valhalla Park and the Goat Range. Wildlife corridors through Bonanza, Wilson, and Kane creek drainages are also especially positive for native species. On the negative side, connectivity to outside areas puts the Slocan Lake Ecosystem at risk for invasive species such as non-native northern pike and bullfrogs which would impact local native fish and amphibian populations. As well, connectivity could encourage the spread of the deadly fungus causing white-nose syndrome that could infect local populations of hibernating bats.

Other suggestions to further refine the ecosystem boundaries include using biogeoclimatic zones and elevation models to further break down the landscape into ecological units (within and across watersheds) by aspect and elevation in order to refine vegetation and habitat types.

Additional information that could further define the scope of the Slocan Lake Ecosystem includes:

- Population home ranges – is the Slocan Lake Watershed big enough to sustain healthy populations and connect meta-populations of key species?
- Movement locations of wide-ranging species to identify critical regional linkages between watersheds and around water bodies.

- Map overlays of logging tenures, Old Growth Management Areas and Community Forest boundaries with watershed boundaries, how do management units dissect the landscape?
- Map overlays of recreational tenures and usage patterns and intensities with critical wildlife habitat and movement corridors to identify possible conflict zones.

In addition, socio-economic connections to Nakusp and Nelson should be considered as part of the 'social ecosystem' because according to one expert these communities are likely to support long-term conservation of the Slocan Lake area.

C. Key Attributes of the Slocan Lake Watershed Ecosystem

Important ecological attributes of the Slocan Lake Ecosystem as identified by the science experts have been summarized under the following five themes: relatively intact; biologically rich; big enough to sustain healthy populations and ecological functions; low productivity and fragmented. The latter two themes do not necessarily contradict the others. In this large landscape contrary forces coexist. The range of descriptions provided by the experts further defines the qualities and values of this diverse ecosystem.

1. Relatively Intact

- Important undammed large lake system in the Columbia Basin.
- Less human pressure on natural processes and ecological functions than in other regions.
- Slocan Lake's foreshore is relatively undeveloped.
- Have excellent examples where the entire elevational span from lakeshore to alpine headwaters is intact.
- Not heavily influenced by big industries, no point sources of pollution, or large-scale human development and infrastructure.
- Where the landscape has suffered from mining and forestry, it is recovering.
- Appears to have enough habitat in a natural condition for functional connectivity.
- Landscape not over-run with motorized use, e.g., motor boats in the lake, ATVs in the valley bottoms and backcountry, or snow mobiles and helicopters in the high country.

Biologically Rich

- Fisheries are diverse with cold-water native species; health of the fisheries is an index for overall the health of the ecosystem.

- Large carnivores such as grizzly bear and wolverine and ungulates such as mountain goats, moose and caribou are still on the landscape.
- Diverse valley bottom wetlands and riparian habitat complexes. For example, from the east end of Summit Lake south along Bonanza Creek to Bonanza Marsh is >2,000 hectares of rich riparian-wetland habitat with high species richness.
- Large wetland complexes in mid-elevations around Wilson Lake, Beaver Lake in the Fitzstubbles watershed, and along Seaton Creek.

Geographically Big Enough

- Large enough area to still contain species and sustain healthy wildlife populations that no longer occur in other smaller and more impacted areas in the Columbia Basin.
- Healthy, functioning processes such as hydrologic connections, water storage, forest regeneration, predator-prey relationships, pollination, nutrient cycling, and fire (depending on the scale and intensity).
- Watersheds are large enough to support adfluvial fish, i.e., fish such as bull trout that live in lakes and migrate into rivers or streams to spawn. Bull trout depend upon connectivity between Slocan Lake and cold, high gradient creeks. Other resident fish such as westslope cutthroat depend on connectivity between creeks and mountain lakes.

Low Productivity

- Steep mountains, narrow valleys.
- Dense, closed coniferous forests.
- Few pockets of productive cottonwood stands and wetland-riparian habitat.
- Oligotrophic lake – low primary productivity, low nutrient levels in Slocan Lake.
- Slocan Valley is not part of a major bird migration flyway; no major staging areas of thousands of waterfowl compared to other regions.

Fragmented

- Natural barriers: Lakes at the coarse landscape scale; cliffs, waterfalls and woody debris/log jams at the fine-scale.
- Human-caused barriers: Residential areas, highways and roads, habitat modifications such as clearcuts and microhydro, and popular recreation areas and trails.

D. Threats & Stressors to the Ecosystem

D. 1 Trends or Issues Scientific Research is Addressing

The science experts described their research in the Slocan Lake ecosystem as addressing overarching themes of: 1) *monitoring population trends* (for example, bats, bull trout, western toads and wolverine); 2) *conserving habitat* (for example, fish spawning areas, wetlands and old growth forests); 3) *protecting native biodiversity* (for example, by preventing introductions of new invasive species, and containing already established ones; and 4) *preparing for climate change* (for example, being aware of predictions and potential future scenarios, and managing for risks).

Current areas of research with a conservation focus:

- Impacts to the abundance and distribution of bull trout due to the loss of spawning habitat and warming water temperatures.
- Barriers and log jams impacting kokanee abundance and spawning habitat.
- Vectors for movement of invasive species via water bodies and terrestrial corridors (road and highway systems, utility corridors, rail trails) – the negative side of connectivity.
- Boat traffic transporting invasive species such as Eurasian milfoil, and zebra and quagga mussels around our region.
- Small infestations of highly invasive species that need quick response: such as giant hogweed, policeman’s helmet, and knotweed.
- Climate change implications for fire frequencies and intensities, hydrologic changes and major ecosystem shifts to drier forest types.
- Amphibian surveys to assess the impact of highway mortality on western toads.
- Wetland surveys throughout the Slocan Valley watershed to assess their condition and identify areas to prioritize for conservation and restoration.
- The abundance and distribution of wolverine – are individual wolverine able to move among mountain ranges in the Central Selkirks and Purcells? How connected are they?
- Locating where bats are hibernating and the conditions they are in given the westward advancement of white-nose syndrome.

D. 2 Most Significant Threats to this Ecosystem

The experts identified four significant threats to the Slocan Lake Ecosystem: 1) invasive species, 2) direct loss of habitat, 3) recreational pressure, and 4) uncertainty of climate change impacts.

1) Prevention of Invasive species

Aquatic

- a) Zebra & quagga mussels – highest priority for maintaining freshwater systems.
- b) Eurasian milfoil – high priority for maintaining freshwater systems.
- c) Northern pike – highest priority for maintaining native fisheries. Slocan River is prime northern pike habitat and it would be devastating to native fish populations if northern pike were introduced into the Slocan River and Lake system.
- d) Bullfrogs – highest priority for amphibian and aquatic systems including wetlands. Bullfrogs would have far-reaching, catastrophic ecological consequences if they were to move into the Kootenay and Slocan river systems.

Terrestrial

- e) Knotweed and policeman's helmet is found in small amounts in the Slocan Lake area – removal of these species is highest priority for maintaining healthy riparian areas; as well as, prevention of yellow flag iris is a high priority for ensuring riparian health.
- f) *Pseudogymnoascus destructans* – highest priority for hibernating bats is to stop the spread of this invasive fungus causing white-nose syndrome.

2) Direct Habitat Loss

Fish

- a) Dams – barriers blocking salmon from coming into the Slocan River and Lake system to spawn.
- b) Sedimentation/erodibility – impacts fish spawning due to logging roads and other access roads located too close to creeks.
- c) Interception/diversion of subsurface water – needed for cold water recharge of creeks.

d) Removal of streamside vegetation and clearcut logging – increased water temperature in drainages impacts fish spawning and survival of juveniles which thrive in cold water within a specific temperature threshold.

e) Woody debris in creeks – reduces access to large upstream sections of spawning habitat. A limited area can cause fish to fight for spawning ground which can disturb and destroy eggs in the process.

Birds

a) Removal of forest canopy cover by logging – impacts nesting and foraging habitat. Good quality summer habitat for migratory birds is very valuable globally.

b) Destruction of wetlands and riparian habitat by logging and development – impacts a large percentage of birds using creeks, marshes and lakes. These lowland habitat types should be a high priority for protection since they occupy less than 2% of the Slocan lake Watershed.

Bats

a) Destruction of summer habitat for bats – will decrease their fitness and ability to resist white-nose syndrome. Bats need optimal summer habitat for rearing successful young, sustaining maternity roosts, and foraging to encourage increasing populations.

b) Permanent closure of mines by the Ministry of Energy & Mines – shuts off entrances and removes access to some of the best bat hibernacula in the Slocan Lake area.

Amphibians -Toads

a) Logging – is destroying upland habitat and over-wintering/hibernating habitat.

b) Loss of wetlands of all sizes impacts amphibian breeding – from valley bottom wetlands up to small alpine lakes; marshes and open water areas with still water, and wet forest types like cedar-skunk cabbage swamps are extremely important. Small pockets spread out over an ecosystem are important for large migrations and viable populations.

c) Docks, boat launches and removal of shoreline vegetation – impact critical amphibian breeding and toadlet staging areas around lakes and marshes.

3) Recreational Pressure

- a) Overharvesting of bull trout by anglers in Slocan Lake – is decreasing an already low population of less than 500 bull trout.
- b) Heavy winter recreational use by heli-skiing operations and snowmobilers in high elevation areas – causes wolverine to avoid or abandon these areas.
- c) Cavers and other recreationists entering caves and mines – could introduce fungal spores of white-nose syndrome on their equipment and vehicles and disturb hibernating bats.
- d) Increased motorized use of the Summit Lake section of Rail Trail – is killing migrating baby toads during their August migration; and could destroy or force abandonment of spotted sandpiper nests in gravels along trail as well as displace grizzly bears and moose that rely on the north side of Summit Lake for foraging, especially in the early spring.
- e) Motor boat use creates wakes – impacts stable water levels necessary on small lakes like Summit Lake during breeding season for loons, killdeer, and spotted sandpipers.
- f) On-going development of local parks – will continue to impact fish and wildlife if the Regional District of Central Kootenay does not develop a clear conservation mandate to guide the establishment and management of its parks. Currently, public access and recreational use are not developed with conservation objectives to maintain and enhance habitat for sensitive species.

4) Uncertainty of Climate Change Impacts

- a) Fire – vulnerability of forests to fire will result in increasing fire frequency and intensity.
- b) Hydrologic changes – more extreme events of flooding and low flow/drought conditions. Having too much or too little water will lead to serious consequences for fish and aquatic systems and for human development and infrastructure, such as culverts on Crown land and water systems in towns. Also, since increased precipitation means increased risks for slope instability, how roads are built and managed will need revision.
- c) Loss of glacial-fed creeks – warming water temperatures requires looking for ways to protect cold water sources so fish like bull trout don't get trapped in upper cold reaches of creeks because they cannot live in the warmer water of lower reaches.

d) Timing and depth of snowpack – impacts wolverine denning and mobility because wolverine need persistent snowpack during the winter.

e) Highly fluctuating lake water levels – impact breeding waterfowl that need stable water levels for nesting.

f) Loss of bat roosting sites – could potentially impact reproductive rates and roosting success. Bats have a fidelity to their birth place (philopatry) so knowing more about these places as climate is changing is critical.

g) Ecosystem shift is a game changer – the predicted shift from Interior Cedar-Hemlock to dry Ponderosa Pine-Douglas Fir or even drier to Sagebrush Grassland at low elevations. Over time expect a re-definition of this landscape with loss of alpine zone and drying up of wetlands.

E. Effective Strategies for Moving Forward

E. 1 What Would Make the Biggest Difference?

According to the experts and the information summarized above, there are five main areas where SLSS and its partners can focus their activities to make a significant, positive difference in the Slocan Lake Ecosystem.

- ✓ Prevent & Control Invasive Species
- ✓ Protect Existing Habitat
- ✓ Enhance Connectivity & Corridors
- ✓ Reduce Recreational Pressure
- ✓ Advance Climate Resilience through Mitigation & Adaption

According to the experts, based on a world of limited time and resources, the following actions are ones that would make the biggest difference ecosystem-wide.

Prevent Invasive Species

- Do all you can to keep zebra and quagga mussels out of Slocan Lake.
- Protect the entire Slocan system from northern pike.
- Anticipate bullfrogs, be ready!

- Help protect bat hibernacula from being infected with the fungus causing deadly white-nose syndrome.
- Control giant hogweed and other high priority invasive species that are already present from spreading.

Protect Existing Habitat

- Maintain large areas of habitat such as in the Wilson Creek drainage where there is caribou habitat – might still have 90 or less caribou moving through this area. Continue to defend caribou habitat for protecting watersheds and other species.
- Advocate for wetlands protection at the provincial level; educate landowners with waterfront and wetlands on the local level.
- Permanently protect productive lowland habitat such as foreshore, wetlands and riparian areas to reduce development nibbling away at natural habitat in the valleys, for example, protect Section 16 Reserve lands around lakes.
- Protect all sizes of wetlands to allow for amphibian migration and for refuge if bullfrogs get established and take over the main water bodies.
- Advocate for key findings from the Fish & Wildlife Compensation Program’s ‘Impacts of Dams’ study in order to protect wetlands.
- Obtain from provincial government the maps of existing Old Growth >250 yrs in the Slocan lake Watershed and immediately go after their protection.
- Reduce winter recreational use in high elevation areas with wolverine and caribou.
- Protect open mines for bats to access some of the best hibernacula in the Slocan Lake area.
- Prepare for white-nose syndrome by establishing good bat populations before white-nose hits by enhancing summer habitat for bats to maximize their fitness. The West might have the opportunity to mitigate its devastating impacts.
- Promote long-term research of Slocan Lake’s indicator fish species such as, bull trout, kokanee, rainbow trout, burbot, westslope cutthroat: What’s their abundance? What’s their distribution, and where do they spawn throughout the system? Fish are good indicators of the health of watersheds and water systems.

Enhance Connectivity & Corridors

- Protect Bonanza Marsh and the east and west ends of Summit Lake because these low elevation wetlands have high ecological values, and are key places for both terrestrial and hydrologic connectivity in the Slocan Lake Watershed.
- Collect more information on stopover habitat for migratory species using the upper Slocan Valley.

- Obtain movement data of large mammals around water bodies, throughout the Slocan Lake ecosystem, and into adjacent Kootenay and Arrow Lakes landscapes.

Reduce Recreational Pressure

- Advocate for changes to fishing regulations to reduce the allowable bull trout harvest by anglers in Slocan Lake.
- Advocate for trail closures prohibiting motorized use of the Summit Lake section of the Rail Trail in spring for grizzly bears and especially where spotted sandpiper and killdeer nest in bare gravels adjacent to the trail. Encourage temporary trail closures for all users during August toadlet migrations.

Advance Climate Resilience through Mitigation & Adaption

- Stop emitting carbon since mitigation is far more effective than adaptation.
- Immediately start planning for climate change for the land base, water resources and communities in the Slocan Lake region.
- Decrease vulnerability to fire risk by reducing fuel loads to significantly increase the size of interface areas.
- Oppose clearcuts because in climate change scenarios clearcuts become increasingly dense and fire-prone, and will burn hotter and more intensely than surrounding natural forests.
- At lower elevations maintain fire resistant trees species of dry forest types such as ponderosa pine, Douglas fir and western larch and reduce fuels around them so they are more likely to survive intense fire.
- Monitor water levels and temperature throughout sub-watersheds in the Slocan Lake system to build a robust dataset over time.
- Approach mitigating climate change by understanding what's going on during low flow periods when mountains no longer store enough water for downstream needs. Identify and protect water recharge sources to learn which streams are fed by recharge from sub-surface sources and which are not. How will creeks, aquifers and wetlands react when water levels change? Where are the sources of water recharge?

E. 2 What are Successful Strategies to Manage Threats?

The experts highlighted many examples of effective strategies, practices and initiatives in the region that are addressing some of the key threats discussed above. The ideas presented have varying levels of detail reflecting the experts' descriptions during the interviews.

Invasive Species

- Central Kootenay Invasive Species Society (CKISS)
 - Successfully works with the Regional District of Central Kootenay and municipalities, and their employees in public works; CKISS also targets meetings with village councilors to reach agreement on what they can do, and how they can partner and leverage resources to address invasive species.
 - Introduces students to “Clean, Drain, Dry” and “Don’t Let it Loose” campaigns by tying the campaigns to curriculum through school programs like Know Your Watershed.
 - Coordinates citizen science veliger (zebra and quagga mussel larvae) sampling in Slocan Lake.
 - Organizes community action projects to be legacy projects for local communities. For example, in Nelson CKISS organized digging up tansy and scotch broom and replanting the area with native species. These projects are great opportunities for messaging and community involvement.
 - Teams up with academia and government to provide important expertise and assistance, for example, research on the Yellow-flag Iris project in Creston.
 - Creates fun ways to reach a broad range of people through invasive species food menus and art shows.

Species-At-Risk

- Bat condo at the Creston Valley Wildlife Management Area has over 2000 bats roosting in it. Plus, many landowners in the Kootenays are stewarding bat populations by maintaining bat roost sites in the buildings on their properties
- Western Toad Project and Toadfest at Summit Lake – the research is successfully informing management decisions and actions; and the public event generates great public awareness.

- Collaboration between researchers to look at metapopulations of wolverine throughout BC, AB and Idaho.
- SWAMP's sampling of wetland associated plants and fungi has led to 'first sightings' of rare species in the Slocan Lake Watershed.

Climate Change

- Forest Stewardship Council, or "FSC", certification for wood products ensures good forestry/logging practices that take ecology and climate change into account.
- 'Area D Water Quantity Monitoring Project' on Kootenay Lake is an ad hoc group monitoring the physical parameters of a range of creeks to assess changes in seasonal flow over time and which streams are most vulnerable.
- CBT's Communities Adapting to Climate Change Initiative has been working with communities and increasing awareness in the Basin.
- Rocky Mountain Trench Restoration Program in East Kootenay focuses on-the-ground management to thin forests, reduce fuel loads, and under-burning.

Connectivity: Dam Removal

- Consciousness within the US to remove dams – western Washington is a good example of making smarter choices around dams.

Other "Bright Spots"

- SWAMP, SLSS, Slocan River Streamkeepers, and Friends of Kootenay Lake are great examples of citizen-led science, are connected to communities, build public awareness, and have developed relationships with local and provincial government.
- Salmo River Streamkeepers have restoration projects that have successfully cleaned up mining sites and tailings; and developed a fisheries sustainability plan for the entire Salmo River watershed.
- Community Forests have a softer touch in the Slocan Valley; they are actively increasing awareness about forest management in the fire-prone Wildland-Urban Interface.
- Village initiatives such as a zoning change example on Arrow Lakes in which the Nakusp Village re-zoned from 'resort residential' to 'reserve' an undeveloped parcel of land it owned between two private properties.
- For the last 50 years, people standing up for their Valley from all groups and interests – that's the strength of the Slocan Valley.

F. Key Considerations for a Science-informed Strategic Framework

The science experts suggested SLSS should consider the following ‘Top 10’ ideas to ensure the Conservation Action Framework is strategic, useful and science-informed.

1. Organize opportunities for informal and formal meetings for biologists to interface with stewardship groups both informally over coffee and more formally in brainstorming and project planning sessions. Several experts emphasized this approach would encourage synergies with professionals on the ground who frequently focus on narrow projects and who would benefit from ties to the bigger picture of the ecosystem.
2. Work with professionals to set common goals / targets for the land base and water resources by pulling together individual researchers to demonstrate how their projects could fit into advancing conservation and stewardship objectives.
3. Become familiar with other frameworks and conservation planning initiatives of larger organizations outside our area to inform SLSS’s approach as well as to get potential buy-in from these groups.
4. Have the framework address the key threats and stressors identified in this Resource Analysis – these provide important entry points for meaningful action.
5. Locate in one place as much information as possible for the Slocan Lake Ecosystem. For example, work with Selkirk College to have the information publicly accessible online.
6. Be a catalyst for more research on key species, habitats and geographies within the Slocan Lake Ecosystem to ensure everyone has sound information on what’s really going on and can monitor change over time.
7. Include science commissioned by SLSS. For example, be sure to include foreshore mapping results that identified critical areas for conservation management.
8. Prioritize partnerships and attend annual meetings with regional initiatives, such as invasive species societies to review priority species lists and results.
9. Build in a strong educational component into all SLSS does – outreach to partners and local communities is essential to communicating good science.
10. Ensure stable financial resources for inventorying and monitoring to counter the “endless running around after scraps of landscape” (as one expert described).

G. Recommendations for SLSS's Role

All of the experts agreed the Slocan Lake Stewardship Society has an important role to play in protecting this ecosystem. Seven key themes emerged to help organize their recommendations for SLSS's activities. Several experts made reference to the back seat government is playing, which means non-profit societies like SLSS must step up and play a greater role in protecting natural resources and delivering education.

1. Lead with Science

- a) SLSS is an important interface between science and the local communities. SLSS should welcome becoming the lead on conservation science for the region surrounding the lake and give explicit thought to this role. As government fades into the background on natural resource issues, local communities will need to take care of themselves. For example, within SWAMP scientific expertise is growing in a local way.
- b) SLSS is an important interface between professional scientists and political action, leading to science-based activism. For example, meetings between SLSS and researchers this fall regarding NACFOR logging plans in western toad habitat and docks in the Section 16 Reserve at Summit Lake were productive for all involved.
- c) Help fill in gaps between different research projects that might not be aware of each other's findings, as is anticipated with the 2016 Science Forum. The Nature Conservancy of Canada hosted a researchers meeting at Darkwoods that the participants found very useful because they learned about what other biologists were doing and about different datasets, and came away with a better appreciation of the larger context for why the area was important beyond a specific species of interest.
- d) Tie the results of SLSS's lakeshore research findings to watersheds that drain into Slocan Lake to further make the connection between water quality and quantity issues with climate change.

2. Volunteer Organizing

- a) Continue early detection strategy of sampling for zebra and quagga mussel veligers in Slocan Lake.
- b) Continue CABIN water quality monitoring on Silverton and Carpenter Creeks.
- c) Install temperature loggers in every creek system. Work with researchers for placement – ensure data is regularly collected and shared. Water temperature is a very important trend to be monitoring for fisheries and overall ecosystem health.

- d) Continue kokanee counts on Bonanza Creek and expand volunteer efforts to sample annual peak count day in Carpenter and Silverton creeks.
- e) Establish bat condos now before white-nose syndrome hits. Use community volunteers to build big elevated bat condos with temperature loggers at Bonanza Marsh and the east end of Summit Lake. Both of these sites are known to have bats, and have calm water for easy drinking and great rock habitat for bats to hide in. Roosting bats need large structures like condos with room to move and with more microclimate options because smaller bat boxes are not optimal roosts because they can get too hot.
- f) Encourage engagement of citizen scientists in monitoring bat populations on their property for the Annual Bat Count.

3. Education

- a) Communicate and share science with government natural resource managers to positively influence management practices in the ecosystem to benefit fish & wildlife.
- b) Disseminate information to the public to increase awareness, for example talking to people about “Clean, Drain, Dry” before a boat is ever launched into Slocan and Summit lakes.
- c) Start educating larger community about climate change, inquiring each time: “And how are you accounting for climate change in what you are proposing?”
- d) Host field tours like “Wild Days” to showcase the ecological importance of this ecosystem.
- e) Educating people about the benefits of bats, how they are an integral part of our ecosystem, the threats they face, how to help bats thrive, and what they can do on their own property to support bats.
- f) Develop strategies to educate local landowners and raise interest and excitement about wildlife in the area by organizing outings that demonstrate the ecological value of private land. For example, when people get a good look at birds they get excited. Raise the profile of wildlife so they appreciate their backyards and help prevent the nibbling away at habitat that can accumulate over time.
- g) Public education especially with private landowners at Summit Lake and Bonanza Marsh. “Tidying up yards” along the waterfront is a behavior that needs changing. These landowners have an increased responsibility to maintain healthy habitat because they are living between two ecosystems of land and water. Deliver the message, “Messy is good habitat,” so landowners realize that cleaning up their yard can remove wildlife trees and shrubs thickets that are essential habitat components.

4. Advocacy

- a) Encourage fire treatment in low elevations by supporting Wildland-Urban Interface fire treatments on a regional basis. Climate change modeling predicts increasing fire intensity, fire storms, and the occurrence of 'run for your life' types of fires – that's what the science says we are headed for. Introduced fires are better controlled fire than wildfire; and carbon emissions better for controlled burns – i.e., there are much higher carbon emissions in natural wildfires.
- b) Insist on FSC certification for Interfor to encourage sustainable forestry practices. By example, in the East Kootenay large areas of private land have been FSC certified by Tembec. When Tembec sold to CanFor, FSC certification continues to be required of CanFor.

5. Conservation, Enhancement & Restoration

- a) Conservation of the Bonanza Corridor is important because it provides a context for conservation efforts, such as: 1) acquisition of the highly valued Bonanza Marsh; 2) changing the zoning and/or acquisition of private parcels at the east and west ends of Summit Lake to establish Western Toad Reserves; 3) restoration of the Rail Trail along Bonanza Marsh, Hunter Siding wetland complex and along the north side of Summit Lake; and 4) comprehensive invasive species management within the corridor.
- b) Help protect the mine along the Molly Hughes trail as a bat hibernaculum. Presently, the Ministry of Energy & Mines does not spend money on conserving bat habitat, and liability issues might trigger it being closed. A local solution is needed; for example, raise \$5000 to build an iron gate to close the mine to the public for public safety reasons while allowing bats to continue to use it undisturbed.
- c) Support the decommissioning roads and rehabilitation in key watersheds because climate change will impact what flows into the Lake. The way watersheds are managed will be key into the future. Basic watershed management actions: 1) advocate for reduced size of new clearcuts; 2) insist on riparian and wetland setbacks to keep new logging and mining roads away from creeks and wetlands; 3) decommission and rehabilitate old logging and mining roads; and 4) remove old culverts.

6. Relationship & Partnership Development

- a) Continue to support researchers and their funding proposals – so appreciated!
- b) Extend water monitoring network and coordinate with the "Area D water quantity monitoring project" on Kootenay Lake. The group could share their information with SLSS because the north end Kootenay Lake's ecology is so similar to the Slocan Lake watershed.

c) Strengthen partnerships with the RDCK and provincial ministries to guide land use planning and conservation management in this landscape. Develop sound enough plans and data to guide where management, conservation and development happen.

7. Regional Conservation Capacity Building

a) Position and make a good case for the Slocan Lake area to be seen by the provincial government and regional funders as an important natural area to invest in as a means to compensate for the impacts of dams in other valleys in the Columbia Basin.

b) Attract the interest of organizations outside the Slocan Valley to bring in expertise. People with influence can help the Slocan Lake region do something significant. What would it take? What would they need to find this area attractive to work in?

c) Attract more research funding through industrial sources, such as occurs on Columbia River with Columbia Power Corporation and Teck, and in the East Kootenay with Teck.

d) Eventually expand this Slocan Lake ecosystem effort to the entire Slocan Valley watershed in order to include the Slocan River, Little Slocan River and Lemon Creek.

H. Looking Ahead to a Science Forum in 2016

This Resource Analysis relied on expert opinion to identify focal species and critical habitats in the Slocan Lake Watershed. It also discussed the most pressing threats impacting the region's ecology and offered some recommendations on how to address them.

As stated at the beginning of this document, the next step following this Resource Analysis is a day-long Science Forum in 2016. The Forum will include science experts that contributed to the Resource Analysis in addition to several local land and water stewards committed to moving the Forum's results into action. The Forum will provide professionals and stewards with an opportunity to consider how ecosystem threats such as invasive aquatic and terrestrial species, climate change, logging, recreational use and residential development could impacts suites of fish and wildlife species; and encourage a coordinated response through restoration and conservation projects that involve overlapping species needs and habitat.

In short, the Forum will get everyone around the same table to think systematically about the future of the Slocan Lake Ecosystem and help build increased capacity to target high priority species and habitats in future projects.

All of the experts contributing to this Resource Analysis support the idea of a Science Forum. They recognized the benefits of being able to take a multiple species approach to inspire

research collaboration and strategic assessment of conservation options. Many were intrigued by the opportunity to examine overlapping ecological interests both geographically and thematically; and to engage more deeply on these topics in light of the greater lake ecosystem.

The Forum will include presentations, small group strategy sessions, and full-group discussion and priority-setting that will result in:

- A summary report called, *The State of the Slocan Lake Watershed* which will prioritize a suite of on-the-ground projects to benefit fish & wildlife and further inform SLSS's Ecosystem-based Conservation Action Framework 2016-2021.
- An outline of additional science research and conservation planning needed for Slocan Lake which is not already addressed in FWCP's Large Lakes Action Plan.
- Longer term research projects that are explicitly linked to SLSS, and include baseline information to prioritize research and stewardship and conservation of species of interest, including bull trout, kokanee, burbot, grizzly bear, wolverine, bats, birds and western toad.
- Increased capacity for cooperation among specialized scientists working in the same landscape to take a multi-species approach to recommendations for future management actions.

I. Alignment with Other Organizations & Action Plans

In developing this process that leads to an Ecosystem-based Conservation Action Framework for Slocan Lake, SLSS has been intentionally aligning their work with the Fish & Wildlife Compensation Program (FWCP) Action Plans to benefit fish & wildlife in the region. The Science Forum will support FWCP's *Large Lake Action Plan* by identifying and prioritizing: a) indicator species and ecological processes that most influence the Slocan Lake Watershed Ecosystem; b) natural and anthropogenic stressors / threats to the Lake system; c) information, inventory and research gaps; d) opportunities for conservation and enhancement objectives for species-based and habitat-based actions; and e) opportunities for stewardship actions and resources in collaboration with land managers, scientists, government, and NGOs in this region to agree on management objectives and work together.

The Science Forum will also support FWCP's *Species of Interest Action Plan*. During the Forum participants will: a) assess the current knowledge regarding the distribution, abundance and/or population trend of species of conservation concern within the Slocan Lake ecosystem; b) develop strategies for each blue-listed and species of local interest (e.g., bull trout, kokanee, burbot, bats, western toad, wolverine, grizzly, caribou) most relevant to Slocan Lake's ecosystem; c) identify actions that would maintain or improve the status of focal species of

concern / interest and critical habitat in the Slocan Lake ecosystem; d) identify information gaps regarding such species in relations to major threats such as invasive species (zebra and quagga mussels, bullfrogs, northern pike), climate change, white-nose syndrome (bats), logging, recreational use, and residential development.

SLSS is also aligning its strategies with CBT's Environment Strategic Plan, and will share *The State of the Slocan Lake Watershed* with other initiatives such as Slocan River Streamkeepers, Slocan Wetlands Assessment & Monitoring Project (SWAMP), Central Kootenay Invasive Species Society, Friends of Kootenay Lake, Kootenay Lakes Partnership, and Columbia Basin Watershed Network.

SLSS also plans to share *The State of the Slocan Lake Watershed* with local residents, local governments (Villages of Silverton, New Denver and Slocan, and RDCK), and provincial government such as, Fish & Wildlife Compensation Program, Ministry of Forests, Lands and Natural Resource Operations, Ministry of Energy & Mines, and other agencies to pinpoint the kinds of education, policy, and conservation and restoration work that will have the greatest impact toward protecting healthy fish and wildlife populations in the Slocan Lake Ecosystem.



Slocan Lake Stewardship Society – Science Interview Questionnaire

Purpose

To obtain scientific perspectives that will inform the development of a strategic Science-based Framework for the Slocan Lake Stewardship Society (SLSS) by providing direction and priorities for conservation, stewardship and education efforts in the Slocan Lake ecosystem.

More specifically, the interviews will capture expert input on key aspects of the Slocan Lake Watershed's biodiversity and overall ecology; identify key threats and potential management strategies; and help determine what data and information is readily available and where there are gaps.

Name:

Phone:

Email:

Agency:

Position:

Years in that position:

Years with agency or organization:

Warm up

1. How do you describe the Slocan Lake watershed (in your own words)?
2. Based on your professional perspective, what is most important about the Slocan Lake watershed as an ecosystem?

Boundaries – Ecosystem View * Refer to Watershed Map

3. What are the defining ecological characteristics of this ecosystem? (if we used different boundaries would the defining characteristics change?)
4. Do you think any more information would be helpful in refining the scope of this ecosystem?

Threats

5. What are the trends or issues your research is addressing in this ecosystem?
6. What do you see as the most significant or critical threats to this ecosystem?

7. What have been the best or most effective strategies to manage those critical threats or stressors? What can you point to as successes?

8. If you could make one recommendation that would make the biggest difference ecosystem-wide what would it be?

Data & Information

9. Given that SLSS would like to develop a clear definition and description of the Slocan Lake ecosystem, its threats, and best management and stewardship strategies, what information and data can you provide to inform that discussion?

10. Do you or does your agency or organization have GIS capabilities?

11. What data and research findings could you share with SLSS as GIS layers to create maps of the ecosystem?

12. In your opinion and based on your expertise, what are the most important data sets necessary to inform ecosystem-wide protection and management decisions? And, is that information readily accessible?

Conclusion

13. Are there any other emerging natural resource issues SLSS should be aware of?

14. In creating a science informed strategic framework that will be most useful across research and conservation efforts, what should we consider?

15. What should the Slocan Lake Stewardship Society's role be?

16. Anything else?

AGREED UPON FOLLOW UP:

**SCIENCE
FRAMEWORK
INTERVIEWS**

APPENDIX B

	Name / Date	Title or Area of Expertise	Agency	Phone	Email	Notes
1	Jeremy Baxter, Aq Tech OCT 8 @ 10:00am	fish biologist	Independent Consultant - Mountain Water Research; BC Hydro	778-456-4566 (o) 250-505-9887	jbaxter@redmtn.ca	107 Viola Crescent Trail, BC V1R 1A1
2	Martin Carver OCT 7 @ 4:00pm	water	Independent Consultant	250-354-7563	aqua@netidea.com	
3	Gary Davidson OCT 5 @1:00pm	birds	Independent Consultant	250-265-4456	gsd37@yahoo.ca	506 - 10th Ave. Nakusp, BC
4	Jakob Dulisse, RPBio OCT 6 @ 10:00am	amphibians and reptiles	Independent Consultant; FWCP projects	250-352-6947 (o) 250-5054977 (m)	jdulisse@netidea.com	410 Second St., Nelson, BC, V1L 2L3
5	Ryan Durand, RPBio SEP 30 @ 9:30am	plant ecologist: wetlands, rare plants, snails	Independent Consultant - Durand Ecological; SWAMP	250-359-7420 (o) 250-505-4776 (m)	rdurand@durandecological.com	4369 Poplar Ridge Cres., Crescent Valley, BC V0G 1H1
6	Doris Hausleitner OCT 14 @ 1:00pm	wolverine	Independent consultant; Selkirk College	250-505-7768 (m)	dorishaus@shaw.ca	2880 Granite Rd., Nelson, BC
7	Cori Lausen, PhD OCT 8 @ 2:00pm	bats	Independent Consultant - Birchdale Ecological; Wildlife Conservation Society	250-353-2891	info@batsrus.ca	PO Box 606, Kaslo, BC V0G 1M0
8	Crystal Lawrence RPBio OCT 23 @ 2:00pm	aquatic biologist	AMEC Foster Wheeler	250-354-1600 (o) 250-551-4614 (m)	Crystal.Lawrence@amec.com	Suite 601E, 601 Front St., Nelson, BC V1L 4B6
9	Wayne McCrory, RPBio Oct 29 @ 7:00pm	wildlife biologist, esp. bears + Toads at Fish Lake	Independent Consultant – McCrory Wildlife Services; Valhalla Society	250-358-7796	waynem@vws.org	Box 479, New Denver, BC V0G 1S1
10	Greg Utzig OCT 13 @ 1:00pm	landscape ecology; climate change	Independent Consultant - Kutenai Nature Investigations	250 352-5288	G13utzig@telus.net	602 Richards St., Nelson, BC V1L 5K5
11	Jennifer Vogel, Exec. Dir. OCT 19 @ 2:00pm	invasive species	Central Kootenay Invasive Species Society	250-352-1160	jvogel@ckiss.ca	

Available & Accessible Data Sources

Data and research findings the science experts are willing to share with SLSS as GIS layers and databases to create maps of the Slocan Lake Ecosystem, and guide management and stewardship strategies.

Jeremy Baxter: 1) Maps of spawning areas and bull trout locations. 2) Information on bull trout numbers, spawning areas, redds, and water temperature in sub-watersheds throughout SL watershed.

Martin Carver: 1) Corrected digital elevation model (DEM) layer for this area – corrected but not an “official product” of provincial government. 2) Assessment watersheds – layer provincial government makes available to provide meso-scale watershed information for management and modeling purposes (does SWAMP or Slocan lake Research Centre already have this layer vs. old 1:50,000 watersheds? If not, Ian Parfitt at Selkirk College has it.

Jakob Dulisse: Western toad breeding locations, distributional and movement data for around Summit Lake and forest land across Highway 6. Recaptures of radio-tagged toad locations on the south side of Summit Lake primarily, but also some locations of tagged adult toads on the north side of the lake.

Ryan Durand: 1) Wetland locations and types. 2) Some rare species locations. 3) Orthophotos for some areas – not for complete watershed and some are out-dated.

Doris Hausleitner: 1) Locations of wolverine. 2) Habitat resource selection function to predict high quality habitat.

Cori Lausen: 1) Bat species found in the region. 2) Locations of roosts and hibernacula.

Crystal Lawrence: 1) Project on Bonanza Creek – marking locations of potential barriers and some habitat delineations by stream reach. 2) Waypoint for every bull trout found. 3) Uses PDF Maps in the field to record point locations and take geo-reference photos – all data is exportable to Google Earth.

Wayne McCrory: A Conservation Area Design providing a coarse scale habitat analysis from the US Border to Prince George using focal species: grizzly bear, wolverine, salmon, OG forests > 250 yrs. Limitation of the CAD is it missed finer levels of biodiversity, such as rare and endangered amphibians, plants, fungi, lichen and snails.

Greg Utzig: All the information generated by the Kootenay Resilience Project is on kootenayresilience.org. Go to MAP: Conservation Project: RLs 2, 12, 13 areas then to Conservation Documents to Draft Summary Report Conservation Plan Map and Values/Management Tables with links. Plus look at Management Strategies.

Jennifer Vogel: 1) Locations of certain invasive plant infestations/treatments in the Slokan Lake watershed, such as giant hogweed. 2) Sampling locations for zebra and quagga mussels in Slokan Lake.

In the experts' opinion the most important data sets necessary to inform ecosystem-wide protection and management decisions are (in no particular order):

1. More comprehensive forest inventory to capture changes in vegetation and forest structure over time. The existing Vegetation Resource Inventory contains mainly tree species and height for timber purposes – mix of information, inconsistent in age and quality and in general “is not a nice layer to work with”.
2. Access to current real imagery as orthophotos or higher resolution air photos.
3. Current satellite imagery to serve as a base map for our area that would allow watercourse analysis.
4. Breeding Bird Survey and Bird Count data that covers our region.
5. Wildlife movement data to provide more information on connectivity and wildlife corridors in the landscape.
6. Locations of bat hibernacula since hibernating bats are the ones that get white-nose syndrome.
7. Consistent logging of water temperature and water levels in the major drainages of the Slokan lake Watershed.
8. Map of all existing Old Growth >250 yrs.
9. Socio-economic data for Area H.
10. Climate change projections for the Slokan Lake Ecosystem from kootenayresilience.org.
11. Mapping of past and projected fire regimes.

Emerging Issues

These two issues are not mentioned elsewhere in this document yet SLSS should be aware of them in developing an ecosystem-based framework.

1) Changes in the Columbia River Treaty: if fish passage for salmon were achieved, what happens if rivers become too warm for them? What if invasive non-native species claim our restored passage ways and replace native fisheries?

2) Ecotourism: the Slocan Valley is an obvious magnet for increased pressure on Slocan Lake, along the Rail Trail, and in the high country.

Issues related to invasive species were mentioned throughout the Resource Analysis; however, big ecological consequences will occur if bullfrogs enter the Slocan Lake Ecosystem.

3) Bullfrogs: their presence was discovered in Nelway last summer and since they travel fast (5km per year) they could begin moving into the Kootenay and Slocan river systems. More monitoring by acoustic devices is needed at the Creston Valley Wildlife Management Area – which is only 20km from the BC/Idaho) border. CKISS and CVWMA are working with Idaho to contain/push back bullfrogs into Idaho.