CDFCP & UBC Botanical Gardens Mapping Solutions Workshop (October 24, 2022)

Regional Framework for Nature Based Solutions in Southwest BC

Pre-workshop QUESTIONNAIRE RESULTS –mapping & spatial data_ (V2)

Purpose: To garner participant feedback on mapping related recommendations proposed during in-depth interviews conducted by CDFCP and UBC Botanical Gardens (between January and September 2022). **This feedback was used to identify areas of agreement and disagreement among participants and narrow down topics for break-out sessions. It will also help provide direction for future workshops and interviews.**

1   Summary Table

Recommendations by Interviewees	strongly disagree	disagree	agree	strongly agree	unsure
General Overarching Recommendations					
Identify and stack preferred spatial layers: biodiversity, carbon, watershed resilience, wildfire risk etc		1	11111111	11111	11
Develop a new set of region-wide maps; vegetation connectivity, land cover etc.	1		1111	111111111111	1
Improve and update existing mapping.		1	1111111	11111111	1
Develop mapping standards and best practices.		11	1111111	111111	11
Land Cover and Change					
Use LiDAR and high-resolution satellite imagery to develop a seamless land cover layer.		11	11111	11111111	1
Use remote sensing to create a land cover change layer that can be regularly updated.		1	1111111	1111111	11
Ecosystem Mapping					
Use LiDAR to derive high-resolution map layers showing forest/vegetation cover to assist with identifying corridors, big trees, mature and old forest, and updating ecosystem mapping.	1	1	11111	1111111	111
Use bioclimatic envelope modelling to map how climate change will affect ecological communities.		11	1111	1111111	1111
Use digital elevation models derived from LiDAR to help identify potential climate refugia.		111	11111	11111	1111
Conduct a regional corridor analysis that transcends local government boundaries, and accommodates climate-driven ecosystem shifts	11		111111	1111	11111
Use remote sensing technologies to regularly update ecosystem mapping.	11	11	11111	111111	11
Support continued expansion and updates of TEM coverage.	1		111	1111111	1111
Request access to ecosystem mapping done on private forest lands.	1	11	111	111111111	11
Explore options for using PEM to update, extend and improve TEM.		1	1111	1111	11111111
Develop a standardized method for updating ecosystem mapping products (TEM).		1	1111111	11111	1111
Explore options for more accurately mapping non-forested ecosystems, including wetlands and Garry oak ecosystems.		1	11111	111111111	1
Explore options for more accurately mapping small forest patches, small wetlands.	1	11	11111111	1111	11
Species & Ecosystems at Risk (SEAR)					
Develop a common and expanded set of SEI classes e.g. Garry oak.		11	111111	11111111	1
Develop cross-walk tables linking TEM, SEI and ecological communities at risk.		1	111	1111111	1111111
Use point feature mapping to capture small Garry Oak patches.	1	11	111111	1111	1111
Expand mapping of potential Garry Oak sites to the CDFmm	1	11	111111	1	1111111
Explore options for using composite distribution maps of animals to help predict the distribution of ecosystems at risk.			11111	1111	11111111

Recommendations by Interviewees	strongly disagree	disagree	agree	strongly agree	unsure
Support development of CDC species range maps and species habitat models		1	11111111	111111	
Explore opportunities for improving crowdsourcing of SEAR observations.		111	1111111	1111	11
Explore options for increasing SEAR point observations and shape files by QEPs	1		1111	11111111	1111
Develop best practices guidance and checklists for site level assessments of SEAR		11	11111	1111111	111
Develop clear guidance on when forested ecosystems are considered to be at risk	11		11111	111111	1111
Develop best practices methodology for delineating and assessing small wetlands at the site level.	11	1	11111	111111	111
Work with Pacific Salmon Foundation (PSF) explore options for sharing and integrating data, and communicating with their data portals.	1		11111111	11111	111
Culturally Significant Ecosystems					
Expand SEI classes to include estuaries and intertidal areas.	11		1111	111111111	
Support and resource First Nations' undertaking inventory and mapping of culturally significant ecosystems.	1		11111	111111111	1
Explore opportunities for working with First Nations to determine if ecological information in existing spatial datasets can be themed in ways more useful and relevant to their interests and objectives	1		1111	111111111	11
Work with First Nations to explore options for recognizing at risk ecosystem elements with high cultural value in BC CDC database	1		11	111111111	111
Explore opportunities to support and resource First Nations in flagging, assessing and undertaking stewardship of culturally important ecological communities at risk		1	111	1111111111	11
Carbon Storage					
Develop an above ground biomass layer for the south coast	1	11	11111111	11	1111
Watershed Resilience					
Derive a digital elevation model using lidar, to accurately identify watercourses, drainage/relief, floodplains and watershed boundaries	11	1	111	11111111	111
Continue to rely on boots-on-the ground methods to map drainage and watercourses in areas with flat topography	11		111111	11111	1111
Extend and enhance wetland and riparian area mapping using new BC-wide topographic riparian area mapping and wetland mapping, produced by Canadian Wildlife Service and The Nature Trust of BC	1	1	111111111	11	1111
Work to collaboratively build agreement on what ecosystem variables are 'hydrologically sensitive", then develop a mapping layer from these variables		11	1111111	111111	11
Wildfire Resilience					
Explore options for using lidar to improve mapping of fuels and wildfire risk mapping	1	1111	1111	111	11111
Cumulative Pressures					
Work with Pacific Salmon Foundation (PSF) on cumulative pressures on watersheds			1	11	11111111111
Look at other options for tracking cumulative impacts			11	111	1111111
Policy, Awareness and Capacity					
Support mapping with boilerplate policy text and guidance suitable for inclusion in planning documents	1		111111	11111	1111
Seek opportunities to build capacity of First Nations, local governments and ENGOs to use mapping layers, through training and mentoring	1		11111	1111111	111
Developing a user friendly interface for accessing a key set of pre-themed map layers	1	11	1111111	111111	
Raise awareness of relevant mapping layers and datasets.	1		1111111	1111111	1

2 Detailed Responses

	strongly disagree	disagree	agree	strongly agree	unsure	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
Overarching Recommendations						•
• **Identify and stack preferred spatial layers:** Agree upon a *preferred set* of spatial layers that best represent different categories of natural assets and the ecosystem services they provide, (biodiversity, carbon, watershed resilience, wildfire risk, etc.), that can be stacked to identify areas of overlap and conflict, and used by local government, First Nations and Provincial decision-makers to identify priorities and balance trade-offs.		1	11111111	11111	11	• I don't think 'stacking layers' is a useful approach because the many biases inherent in such exercises and widely discussed in literature prior to development of 'prioritization/optimization' models • Difficult with different scales. Often the most locally accurate data is municipal. We typically check municipal, regional, and provincial datasets in an environmental assessment as they provide different information. • Could work well if you can integrate all scales of data, with real time updates • Would be tricky with different methodologies and scales of effort to the municipal data. • This could be a bit challenging if individual jurisdictions have different data layer needs (may not be one-size-fits all). • Agree an inventory of applicable layers and their sources and metadata would be valuable. I'm not comfortable with the concept of "preferred" but see value in noting pros and cons of use of different layers for different purposes. Preferred layers, even for the same resource values, may change dependent on the analysis being done, objective relative to that value, audience, geographic area of interest, temporal period of interest, and other criteria. • There may need to be some weighting of the layers to help with prioritization. • If these layers could also be "turned off and on" that would be greatly appreciated. A separate layer showing where all these natural assets and ecosystem services overlap would also be appreciated (in other words, a layer showing only these "hotspots"). • Stacking alone does not deal with spatial connectivity of features, comprehensive, adequacy, representativeness or efficiency. If the goal is to identify options, then using a spatial optimization tool like prioritizr or Marxian would be good to include. We have already developed a protocol for the islands trust that we can share (speak to Tara Martin - UBC) • Not sure what this means. Are we talking about a set of spatial layers developed by and hosted by the Province? or at a regional level, or? • I think this is a great idea, but I don't know if all of these layers exist or if they, do how reliable they are. • Could be interesting for group session. • "Preferred" layers may depend on the region and/or purpose, which would have to be well-defined for this exercise to be most useful. You may not find a uniform "preferred" set for the entire CDF, or will have to compromise and use coarser data if your priority is comprehensive coverage (vs. resolution).

	strongly disagree	disagree	agree	strongly agree	*unsure*	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
• **Develop a new set of region-wide maps:** Prioritize collaborative development of accurate (5-20m) region-wide (south coast) map layers derived from remote sensing (lidar[1] and high resolution satellite imagery), including: • vegetation structure and connectivity • land cover • land cover change • above-ground biomass • topography/drainage	1		1111	1111111 11111	1	• The level of resolution indicated will be attractive to those who 'believe' in the value of precision, or are required to make fine-scale planning decisions. But the errors in such data and rapid pace of change in local conditions makes this a 'fools gambit' that has the potential to convey false confidence about the reliability of results, will cost too much to validate sufficiently, and will be out of date within a few years unless one relies on remote-sensed methods that are fraught for other and related reasons. • I assumed spatial products not hardcopy map products • only if other mapping products are not considered to be suitable • A big yes, and yes to exploring October 24th • Looking for some clarification on the question. Are you interested in determining levels of resolution that would be ideal for answering specific questions or planning for certain resources OR Are you interested in developing standards and methods for meeting a certain level of map accuracy (or determining at what resolution you can reach what level of accuracy for different attributes)? • Creating a land cover dataset and assessing change over time is a desired goal for the Sunshine Coast Regional District • Developing these maps for Metro Vancouver has been a focus for the last 10 years. Having them has driven the conversation forward significantly. • Even having available the subsurface geology/soils map layers is helpful. • After development of these maps would need to incorporate a plan for regular updating including who, funding source, rule set for updating • Good for exploration in group session. • I'm particularly interested in land cover/land cover change if it is coded in a way that directly addresses some of the formal threats categories used by IUCN/NatureServe. • Note that most government data are in vector (as opposed to raster) format. • Getting that private LiDAR into the public realm would definitely be worthwhile.
• **Improve and update existing mapping:** Focus on fostering collaborations that pool resources and expertise to improve and update existing mapping products, *using map layers derived from lidar and remote sensing (as above),* and other innovations.		1	1111111	1111111 1	1	• Depends on capacity and existing resources of contributors. • Agree that for many of the attributes and values noted above improving and updating mapping through collaborations is ideal. Developing a shared understanding of map layers, inventory and mapping programs that exist (in particular provincial government inventory, ecosystem mapping, and LiDAR data programs) is critical, and determining how partners can work together to enhance those effectively is important. But I'm not clear on the second part of the statement. Is the question just about the utility of using remotely sensed data to enhance existing mapping? I believe the question should be broadened – what data sources or practices would best be used to improve or update existing mapping (this will of course depend on what maps you are referring to and what you want to do with the updated ones). • Ideally yes. There are always trade-off decisions that have to be made when creating maps which might be difficult if different organizations have different priorities.

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[1] Work with UBC and other partners to negotiate user agreements with holders of private lidar data, to collate lidar data sets across the study area, for the purpose of deriving new

	strongly disagree	disagree	agree	strongly agree	*unsure*	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
						• Where it makes sense to collaborate and share, yes. But I also think it is important to have some level of control over our mapping. By doing it ourselves, we are more invested in it, and the final product is probably more customized to our community's needs. • There currently exists multiple mapping products for the region, e.g., BC CDC element occurrence mapping, TEM and SEI. SEI can be modelled from TEM. TEM is data intensive but can be used for wider applications and provides full coverage of a study area. Many of the mapping products are getting out of date and need updating. Field data associated with these products are indispensable and should be retained and utilized for map updates. • As worded, this seems fairly general and is hard to disagree with! I would probably add that we need to **generate and transfer** more expertise, since most top experts are working at capacity or moving rapidly toward retirement.
• **Develop mapping standards and best practices:** Focus on supporting collaborations to develop/improve mapping, standards, methods and best practices for the south coast, and guidance for its use. •		11	1111111	111111	11	• Update to already existing provincial mapping standards and region specific BMPs potentially • Expectations around clear methods, data sources, *etc.* rather than best practices would be preferable • Not even sure what standards are out there, or how they differ etc • Strongly agree that standards would be developed. For most of the layers of interest these would start as provincial scale standards and then could/should be modified if necessary or appropriate by question and extent (for specific south coast stewardship or management needs/values). • Locally relevant guides would be helpful, e.g. using data available in the region, climate conditions, species/ecosystems etc. • As resources allow. • While standards exist, we need to agree on mapping objectives for consistency through the region. • Generally speaking, there are pretty good standards out there but some areas could use improvement such as mapping and delineation of smaller features, non-forested ecosystems, and wetlands. • Emphasize the "guidance".
Land Cover & Change						•
• **Land cover:** Use lidar and high-resolution satellite imagery to develop a seamless land cover layer for the south coast study area, that can be regularly updated using remote sensing and automated methods		11	11111	11111111	1	• Depends on cost, given other opportunities. Costs for some projects reviewed, given reliability, suggests more practical methods suffice • A big yes, and yes to exploring October 24th • Possibly. Would depend on what level of resolution (questions) were of interest. Seamless land cover is certainly a desirable goal, but the mechanism would depend on the classification of interest. That is, I can see getting conifer vs. deciduous vs. converted land uses from satellite imagery. And some measures of structure from LiDAR. But getting to a finer classification (species composition, site condition) would be tough. Longitudinal data may be prohibitive to acquire at the period of interest? So think the conversation on modelled vs. remeasured vs. some combination (and what is done when measuring through what type of remote sensing) is critical

	strongly disagree	disagree	agree	strongly agree	unsure	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
						• Once you have a good, high-resolution land cover (3-5m), there are so many other things you can do - ecosystem connectivity analysis, tree canopy cover, impervious surfaces etc. • I only "somewhat agree" because I could see this aspect of the project being costly, and time-intensive to build up and maintain. • What region are you referring to by 'south coast' ie. what side of the border? • Yes, as long as it is at a level of detail useful for our purposes. • I think land cover data is not detailed enough to address some of the major conservation concerns in the region. • Heck yes! • Not my area of expertise, but I would like to see it happen and would use this product. • A few caveats: 1) limiting to the south coast study area may hinder the usefulness of this layer – consider shaping it around BEC or some more ecologically meaningful boundary, or at least consider what is happening in adjacent regions to avoid future confusion and 2) see notes above re: coding or categorization of land-cover.
• **Land cover change:** Use remote sensing to create a land cover change layer that can be regularly updated to track change, using cost-effective automated methods. Update land cover maps (and other maps) by 'burning in' change layers.		1	1111111	1111111	11	• Depends on cost, given other opportunities. Costs for some projects reviewed, given reliability, suggests more practical methods suffice • This one seems to lead on from the last; why would you create one without the other? • Would need to know what "burning in" change layers means? • See comments directly above. • Efficient updating processes are key to keeping the cost down. Also look for ways to update other data layers once the areas of change have been identified from the land cover. • I'm a little unclear what this statement is saying. What is implied by "land cover change"? Areas of deforestation? Urban development/encroachment on forests? Wildfire damage? All of the above? • Similar to above while I see the value there may be better products out there to map landscape change. • Could be good topic for group discussion. • See notes above, but this could be a great way to spatially quantify and address growing and emerging threats (or track successes). Usefulness will depend on whether resources are truly available to update this on a realistic cycle.
Ecosystem Mapping						•
• **Vegetation cover:** Use lidar[2] to derive high-resolution map layers showing forest/vegetation cover, structure and height across the south coast	1	1	11111	1111111	111	• This is easy to do for focal spp. already, but it is nearly impossible to do with precision across species – as demonstrated in much published work. • Yes, but often regional scale mapping exercises like this aren't as accurate as municipal

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[2] For examples, see:
NRCAN: https://www.nrcan.gc.ca/science-and-data/science-and-research/topographic-information/whats-new/high-resolution-digital-elevation-model-hrdem-generated-from-lidar-new-data-available/23005
Lidar BC portal: https://governmentofbc.maps.arcgis.com/apps/MapSeries/index.html?appid=d06b37979b0c4709b7fcf2a1ed458e03

	strongly disagree	disagree	agree	strongly agree	unsure	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
study area. Use to assist with identifying corridors, big trees, mature and old forest, and updating ecosystem mapping (e.g. SEI, TEM).						ones, so would have to be very clear on level of accuracy. Would ideally have an error margin if reporting stats. • If lidar is the best way forward to do this, then "agree". If not, then other methods should be discussed/explored. • The key here is resolution and scale. For local govts a much finer scale (e.g., <1ha) is needed, whereas SE scale may miss important smaller patches of connectivity or refugia. Man wetlands and other highly sensitive ecological communities get missed because of this, especially in urban areas. And yes for October 24th. • I agree that LiDAR to support structure and height mapping MAY be a good investment. I'm less inclined to think that this is where we would put our funds in terms of development of vegetation classification and mapping of cover and of the classification. That said, this latter continues to be an interesting area of research. I do believe that there is opportunity to use LiDAR (along with multiple datasets) to refine mapping of our classification and identify areas where the classification could be effectively refined (e.g., further use of tools like eCognition). • Updated SEI and TEM layers would be good. TEM data seems to not extend into some of our Provincial Parks - why? The province's Old Growth mapping seems quite good on that front: https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/old-growth-forests/old-growth-maps • Maybe. Would need to understand how intensive (time, money) this would be. A lot of forest info can be gathered from reviewing ortho imagery (structural stage, deciduous vs coniferous, mature vs old etc.) which may be quicker than a detailed lidar analysis for the south coast. Not sure how you'd use this type of analysis to identify corridors? Land cover is probably more useful. Creating land cover using Lidar seems more efficient and you get more than just veg cover. • Limited use to the CDC if it's not to site series or plant association (i.e., for getting at red or blue-listed ecological communities), but could be useful to generally identify ecosystems of interest for conservation (e.g., wetlands, old/mature forest, bluffs).
• **Climate Shifts analysis:** apply UBC's bioclimatic envelope modelling[3] to map how climate change will affect the composition and distribution of ecological communities across the south coast study area.		11	1111	111111	11111	• This is already sufficiently well-known. The precision of any such prediction is dramatically affected by a range of assumptions for which we have no strong reason to choose one scenario, and the mean of all has huge variance. This can only be done to very course approximation, and can only be relied on very generally re: scale and outcome given complexity of communities. • Can this be done for more than just expected tree movement using UBC methodology? • Not familiar with this modeling, would like to see examples on the 24th to determine value. • This is being done actively – coordinate with MoF provincial and regional research ecologists (and UBC partners). • (the scale is shifted on this one!) I agree that this would be useful. I put somewhat agree

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[3] See: Centre for Forest Conservation Genetics climate data and models (https://climatebc.ca)

	strongly disagree	disagree	agree	strongly agree	*unsure*	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
						rather than strongly agree because I don't know too much about what the results would be, what resolution they would be, etc. It would need to be somewhat fine to be really useful. • My team is working on this via 2 PhD projects underway and my NSERC on cumulative effects in the Salish sea • I'm not sure at this point how this will be used at the local level. Would like more information. • Great, but what will this tell us? See topic below. This seems like a largely theoretical/modeling exercise until you also consider limitations imposed by land use/land cover and site-specific factors. • I believe relatively little empirical work has been done to determine what the actual impacts on composition and distribution of ecological communities is expected to be in terms of their condition – at what point do the communities simply become "novel" and what is the relative conservation value of those novel communities?
• **Climate refugia analysis:** Use digital elevation models derived from lidar to help identify potential climate refugia (low lying, shaded pockets that are likely to be cooler and moister than surrounding areas)		111	11111	11111	1111	• This is already sufficiently well-known. The precision of any such prediction is dramatically affected by a range of assumptions for which we have no strong reason to choose one scenario, and the mean of all has huge variance. This can only be done to very course approximation, and can only be relied on very generally re: scale and outcome given complexity of communities. Available already and cant be done a lot better. Snake-oil to claim otherwise. • Climate refugia have a broader definition than what is being suggested here. Refugia are areas that are not expected to have much change over time, whether they are low-lying or not, etc. • This would be useful to help land use authorities identify important acquisition opportunities (not just biodiversity hotspots, but future important areas for biodiversity based on climate refugia values). Though unsure if this will work as well for some of the South Coast landscapes where terrain may be less distinct, or masked by urban development? Would need to know more – add to October 24th. • Yes – an interesting area for research and operational planning. Again, though, I'm not so sure the focus on LiDAR derived models is necessary for many of the first steps in identifying topographic and disturbance determinants of refugia. Much could be done (compare to other models, e.g., UNBC – Phil Burton work on this and other jurisdictions) already and perhaps the scale at which we would be applying these models in management would not warrant LiDAR derived DEMs (or at least we could get started and then update as more or better LiDAR became available). • (again, scale shifted) This is another piece of analysis we're interested in doing. Again, not sure about resolution. Would need to be somewhat fine scale to be useful. • as resources allow • Potentially interesting but has then been tested? What are the target species? • Potential topic for group discussion, if the right people are there. • I would consider this to be the more important step following from climate shift analysis described above.

	strongly disagree	disagree	agree	strongly agree	unsure	Comments & Suggestions (also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)
						• Consider factors besides DEMs. Potential to protect meaningful diversity will need to consider things like connectivity to existing communities or populations, soil types/nutrients/moisture, areas of hydrological vulnerability or resilience, land use/cover. • Consider flexibility to set thresholds for "significant" areas worthy of conservation (e.g., what if refugia analysis suggests that NONE of the current red and blue-listed ecological communities are predicted to persist in this region 100 years from now?)
• **Regional Corridor Analysis:** Using the above layers conduct a south coast regional corridor analysis that transcends local government boundaries, and accommodates climate-driven ecosystem shifts.	11		111111	1111	11111	• Already possible and useful. • Yes, but this is a big undertaking. And corridor/connectivity can have a lot of values based decision making associated with it (are you just valuing connected pervious areas including things like grass? Old growth forests? Mature forests? Do you go by the biodiversity they support, based on the number of species that use them, the importance of the habitat to the most species or species at risk, etc.? What's your width requirement? Is there a minimum size/length/area?). • Would require a lot of the earlier work to be completed first to have updated information to base this on. • I'd be interested in learning more about this topic, along with the above Climate Shifts analysis in the group sessions • Not sure what "above layers" are being referred to here. • As long as scale provides details needed for local govt planning and monitoring. • Don't know much about this • This sounds good but based on what? What is incorporated into the analysis? Are we talking structural connectivity? Functional connectivity? considering just biodiversity or also more human-related factors? Can't say if it's a good idea until knowing a bit more • Again - what region is the south coast? • as resources allow. • Most useful if there is a mechanism available to achieve conservation of those corridors.
• **Ecosystem change:** Use land cover change layers derived using remote sensing technologies to regularly update ecosystem mapping and track ecosystem conversion rates in a cost effective way[4].	11	11	11111	111111	11	• Not possible with sufficient reliability to advance successfully • This one seems more important than Land Cover Change (on its own). Not sure if both are required – I guess it depends on the methodology used to update this one. • Not sure how this differs from some of the other proposed components? • Definitely. This is what we're doing at MV and trend data is the thing that gets people's attention • as resources allow. • Useful for group discussion, though it may lead to discussions about data-systems to support this. • See previous notes about linking these to formal threats categories. • In an ideal world, these could be integrated with conservation status ranking for ecological

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[4] Recognizing that interpretive methods that have been used to map ecosystems in BC are expensive, labour intensive and very difficult to replicate and automate. Repeated wall-to-wall updating of ecosystem mapping is not a good option for tracking change, due to cost and compounding error.

	strongly disagree	disagree	agree	strongly agree	unsure	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
						• communities that are entirely within the study area (i.e., if levels of conversion hit a certain threshold, a community would go from blue-listed to red-listed or yellow to blue, etc). • This would help me do my job, but not necessarily have an impact on conservation without ties to policy or legislation that can address the important threats (e.g., causes of land-conversion).
• **Terrestrial Ecosystem Mapping (TEM) coverage:** Support continued expansion and updates of TEM coverage across the south coast, to fill existing gaps[5].	1		111	11111111 1	1111	• Typical TEM coverage is based on 1:20,000 TRIM with a minimum polygon size of 2ha. Polygons as large as this could miss important Ecological features. I think a finer scale – smaller minimum polygons are needed. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/tem.pdf see table 3-14[i] • How is this one different than "Vegetation Cover"? I think TEM would be a higher priority than developing other vegetation cover mapping. • Will it be detailed enough? Can look at CRD examples • We (MoF/MoE) have number of documents that have been developed in the past 10 years to present a case for ecosystem mapping (see comments below re: PEM – I think we want ecosystem mapping province wide but make no definitive comment on whether this would TEM or PEM) in the south coast (e.g., to LBIS trying to get a new investment category). Suggest pulling together some of these legacy docs for any useful material and adding new priorities/initiatives that would be supported by ecosystem mapping. • Tetrahedron Provincial Park (our community water source!) and Mount Richardson Provincial Park • Not sure. TEM is very intensive and doesn't work well in more disturbed areas. Would need to first identify why TEM and why not SEI, land cover, etc. TEM gives you the connection to ecosystems at risk info which is useful • as resources allow, at appropriate level of detail that affects local government management • TEM likely fills the widest set of objectives and can be modelled to produce SEI maps. Regularly updating disturbances through TEM can be used to track ecosystem change. Disturbance updating can access provincial data sets e.g., cut blocks, roads, fires, etc. and be aided by a LiDAR derived DEM updated yearly which shows change in elevation on disturbed ground. Requires a high-resolution DEM (i.e. 1m) • Agree that TEM is the "gold standard" but also worth recognizing that other regions in BC have no TEM at all and may be higher priority.
• **Private forest land:** Request access to ecosystem mapping done on private forest lands, which currently is not public, to help fill gaps in TEM coverage.	1	11	111	11111111 11	11	• Because the condition of private lands will necessarily dictate success in spatial planning in all developed regions with more than about 50% private land, this is essential for any regional planning exercise that purports to be comprehensive of an area. • Without knowing how much PFL is actually in the South Coast not sure how important this will be? • sure, if you can get it. Again though, what kinds of info are we looking for that we're not getting from mapping that can be done remotely (SEI, Land Cover)?

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[5] Recognizing that many other useful map layers can be derived from TEM, including SEI, and that TEM allows for updates to be made to structural stage classes (using modeling).

	strongly disagree	disagree	agree	strongly agree	*unsure*	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
						• VERY strongly agree. Have some people already been working on this? My guess is that it is more complicated than a simple "request".
• **Predictive Ecosystem Mapping (PEM):** Explore options for using PEM on the south coast to update, extend and improve accuracy of TEM.[6]		1	1111	1111	11111 111	• See TEM comments re smaller minimum polygons are needed, • Id have to be convinced. Many feel one can't progress without data, but in BC requirements for 'better data' could be argued as a key impediment to adaptive management and monitoring, based on what we already know well. • TEM/PEM comparison pilot studies could be useful • I would suggest applying tools like these over private lands, rather than requesting access • Will be useful to fill in gaps, but only if we have sufficient data to ensure acceptable level of confidence in results. • It's always worth considering utility of PEM vs. TEM. The comparisons of cost effectiveness, feasibility and potential utility depend on logistics associated with the landscape, base layers available (and how expensive these are to get!), the expected use of the data (at what resolution and over what spatial extent does one need what level of accuracy) among other considerations. The ability to model effectively will also depend on the ecosystems. We have a few projects in some parts of the coast that have demonstrated greater accuracy of TEM over PEM or TEM/PEM hybrid (and lower costs), particularly in areas of atypical soil/moisture conditions with topography. That said, newer modelling tools and remotely sensed data may change that situation for some areas. Nonetheless the apparent assumption here that PEM might be an improvement over TEM is inappropriate. One might, for example, do a PEM with the data available at one (coarser) resolution to give a starting ecosystem map until TEM could be completed. • I don't know enough about PEM and how it works in more urbanized environments. • need more info on what is meant by this • There may be other more knowledgeable people at this meeting (or in the province in general?), but my guess is that PEM could best *extend* and compliment rather than improve TEM.
• **TEM structural stage updates:** Develop a standardized method for updating ecosystem mapping products on the south coast, to give them a longer life; e.g. using structural change modeling, lidar, remote sensing, etc.		1	1111111	11111	1111	• Useful for carbon modeling. • Clarifying and consistently applying TEM site codes would be great as well. Sometimes we come across TEM codes without clear definitions. • This should be bundled with re-mapping of both BEC zones and SEIs – neither is so useful by itself as to be high priority • Would need to see examples to determine if useful • Yes, there are a number of projects in play within government related to this (one of them specifically over the past 4 years towards developing provincial standards for structural stage modelling and updating). Suggest coordinating with those so folks are working collaboratively. For the latter (which is using GBR and sunshine coast as case studies for

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[6] See: https://www.researchgate.net/project/Advancing-Predictive-Ecosystem-Mapping-Methods-for-Multiple-Scale-Ecological-Interpretations-of-Climate-Futures-in-British-Columbia

	strongly disagree	disagree	agree	strongly agree	*unsure*	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
						- methodological development and analytical framework) you can contact me or Jackie (Saunders or Churchill). - Not sure I understand this one. Do you mean aging ecosystem mapping datasets generally? If there was a way of automating that, yes, that could be useful. - Again - where is south coast? - need more info on what is meant by this - Could integrate well with other topics on regularly updated land-cover data, including ability to (re)assess the 'state' of at-risk ecological communities threatened by changing land-use.
• **Non-forested ecosystems:** Explore options (including lidar and high resolution imagery) for more dring non-forested ecosystems, including wetlands and Garry oak ecosystems (to address the issue of TEM not being designed to pick up non-forested ecosystems).		1	11111	1111111 11	1	- Maybe but we already know this from TEM except on private. - Hugely important for urban areas, yes to exploring on the 24th - We are expanding our TEM by incorporating BC Wetland Classification coding. It doesn't include all wetlands in our system, but it certainly improves TEM from what we had before. Yes, more automated methods to support non-forested ecosystem mapping could be helpful. Not sure if you can get away from needing lots of fieldwork though. - My team has a mapping project underway to map GOE in Canada - mapping the historical and current distribution using a combination of historic aerial images, interviews with First Nation elders, phytolyth analysis, satellite imagery and LiDAR. (Contact Tara.Martin@ubc.ca) - need more info on what is meant by this - TEM works okay for non-forested ecosystems but can be limited by map scale. The finer the scale the more precise the mapping. - Consider what sort of units are feasible to map in this product (e.g., site series? plant associations?). Will this really be a substantial improvement on TEM? - How would these data be held or accessed?
• **Small patch ecosystems**: Explore options (including lidar and high resolution imagery) for more accurately mapping small forest patches, small wetlands, etc.	1	11	1111111 1	1111	11	2ha limit on SEI is directly responsible for loss of many outstanding local habitats with red-listed spp. present being developed because permits were issue in absence of good info to planners. - Not sure how this one is different from "Non-forested Ecosystems - Hugely important for urban areas, yes to exploring on the 24th - high resolution land cover classification can pick up small forest patches. Agree new methods would be helpful for identifying small wetlands - This may be more important for smaller communities where small patches are critical - Sure, but to what end? At what point does this become the responsibility of QEPs working in specific areas? The purpose of this mapping would rely on guidance/requirements for how to treat these forest patches or wetlands. - Seems there is overlap with this topic and others.
Species & Ecosystems at Risk (SEAR)						•
• **Sensitive Ecosystem Classes:** Develop a common and expanded set of SEI classes for the south coast, to better capture at-risk ecosystems, (including Garry Oak and savannah ecosystems, flood plain forests,		11	111111	1111111 1	1	- We know this IMO - SEI classes exist to capture these features – perhaps definitions could be revised/clarified (i.e. Woodlands, Riparian, Old Forest, Mature Forest etc.) - Needs to be transferrable across the variable subzones (e.g., southeast Van Isle versus

	strongly disagree	disagree	agree	strongly agree	unsure	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
and well-established forests), and standardized methodologies for deriving them.[7]						Lower Mainland). • There is a need for additional classes, and some rationalization of existing. We made some recommendations in the SEI Technical Report (2014) (our website isn't showing the link right now but it should be fixed soon) • The soon to be released updated Vancouver Forest Field Guide will include a greater classification of at-risk ecosystems including new codes for Garry oak ecosystems • This could be a good topic for discussion at a workshop, if the right people are attending. It sounds like SEI is a product that people find useful and will continue to use or build on – particularly examples like metro van. • Consider how SEIs are used or applied. Do SEI classes have legal implications, or can they be cross walked to units that have legal implications? Are SEIs more useful or less useful than a TEM that can be used for site series or ecological communities? • Whose responsibility is it (or should it be?) to initiate/fund/update SEIs?
• **Crosswalk tables:** Develop cross-walk tables for the south coast, linking TEM, SEI and the BC Conservation Data Centre's (CDC) ecological communities at risk data sets		1	111	1111111	1111111 11	• Specialized uses are hard to comment on. One typically ID's the question first? A lot of money and time goes into 'better data' with typically little consequence for policy in CDF/BC • Large undertaking. We do this for City's sometimes and the polygons never match up which makes it hard to assign without increasing the number of polygons. • ? The CDC ecosystems explorer indicates which site series support communities at risk (so these could be picked out of the TEM). Maybe I don't understand the suggestion? • yes, this would be helpful. We published our crosswalk in an Appendix of the SEI Technical Report (2014) • need more info on what is meant by this • Some of this work is ongoing/underway. • I would add "BEC" (and nBEC) to this, noting that this might be timely with work on the new west coast field guide and that guide could be a good place to present some of those tables (or publish them at a similar target date).
• **Small Garry Oak patches:** Use point feature mapping to capture small Garry Oak patches.	1	11	111111	1111	1111	• Better to capture (survey GPS) 1:5,000 scale polygons (0.25 ha) • Even though they are 'everywhere' in the SGI's but hidden under 40-80 year old firs having invaded thin soil in absence of fire. But just use lidar…. • Need a good definition of what a "Garry Oak patch" is. Lots of disagreement. Number of trees? Age of trees? (un) disturbed understories? • Don't know anything about this • may not be relevant to our area • I'm not sure how useful this would be unless tied to clear conservation outcomes through policy or legislation. Is the purpose to look for land to acquire? Locations to restore? • Some folks at UVic did some recent work on summarizing Garry oak restoration sites in a public map.

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[7] See Update of the Metro Vancouver's Sensitive Ecosystem Inventory, (http://www.metrovancouver.org/services/regional-planning/PlanningPublications/SEI_Update_2020.pdf).

	strongly disagree	disagree	agree	strongly agree	unsure	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
• **Garry Oak potential:** Expand mapping of potential Garry Oak sites to the CDFmm (currently mapped for CWHxm1)[8]	1	11	111111	1	1111111	• So many intervening factors affect GO, it would be a complete and utter guess • Based on experience of work in CWHxm1 by Madrone - potential ratings were not a reliable indicator of GO presence due to scale of mapping and small size/rarity/patchy nature of these communities. and difficulty distinguishing GO from similar species (stunted arbutus, hairy manzanita, oceanspray) • Not sure what this one means/entails. How would potential sites be identified? • ? Can't the TEM for the CDF be used in this way (indicates potential for specific sites/communities) • may not be relevant to our area • I am skeptical this is needed considering the amount of existing mapping in the CDFmm. • I think there's reasonable knowledge of where the remaining/potential GO exists that can be derived from older analyses (e.g., Ted Lea's work), or the CDF TEM. • The footnote re: Indigenous stewardship is highly important and needs to be explored.
• **Animal models:** Explore options for using composite distribution maps of bird guilds and other animals, to help predict the distribution of at risk ecosystems (e.g. wetlands, old forest, savannah, Garry oak prairie, etc.)[9].			11111	1111	11111111	• Easy based on data available • This seems like a bit of a roundabout way to get this information. Is this easier than using LiDAR? • It would really depend on the level of accuracy/coverage of the underlying data for species observations. I'm not sure that we have the necessary data to be able to do this well. • We used guilds for Surrey's BCS, but not sure how effective this approach will be at a larger scale. The SCCP tried to develop something similar for SAR conservation, but it was a bit unwieldy and was abandoned. • No idea if this is effective • may be too detailed for our community's purposes, at this point • This could be an interesting topic for the workshop. I guess Peter Arcese is working on this? • Is the implication that it's easier to map guilds than it is to map at-risk ecosystems? I do think that this could address a bit of a 'gap' in our concept of ecosystems, which is that we map 'ecosystems' at plant associations without regard for what animals reside there.
• **Predictive maps for species at risk:** Support continued development of CDC species range maps and species habitat models, to flag areas likely to support different species at risk[10].		1	1111111111	111111		• Need to see examples to determine how accurate it may be, data can be misused by QEPs for private sector development (SAR considered absent based on model versus actual ground-truthed not detected. • Yes, this could be helpful. I'd like to understand how this functions in more developed urban environments. • As stated, this is ongoing and will only be as good as the layers and data from which it is derived. I believe Jacqueline Clare would be the best person to address this, and I don't think she'll be attending.

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[8] To help address the issue of Garry Oak ecosystems being difficult to map because of forest infilling, and to identify areas where First Nations stewardship could help restore highly degraded/infilled Garry Oak sites.
[9] See: NPLCC Prioritization Tool, (http://nplcc.labs.ecotrust.org/media/docs/NPLCC_FocalSpecies.pdf)
[10] See range maps developed with BC CDC for at risk amphibians and reptiles in BC (https://bcreptilesandamphibians.trubox.ca/range-maps/).

	strongly disagree	disagree	agree	strongly agree	*unsure*	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
• **Crowd-sourced reporting:** Explore opportunities for improving crowdsourcing of SEAR observations, by developing, improving, streamlining and raising awareness of reporting interfaces.		111	1111111	1111	11	• If not based on presence-only data which is hugely biased and should not be used except in very special circumstances, especially in SW BC because unsurveyed private land is typically of higher quality and supports more rate spp. than public lands, esp on se VI. • Who would be able to submit these observations? Would it have a vetting process? I'd consider requiring them to be submitted by a QEP (or CAB member?) with random vetting. Reviewing all submissions would be a lot of work. • This could be useful for mapping keystone species occurrence – species that are easy to identify, noticeable, and useful to predicting ecosystem presence (like camas). I worry it's not that useful for at-risk species • We don't need to do this, just support and improve on usability of existing platforms like iNaturalist, eBird etc. • Comments on Crowd-sourced reporting, if any? • What role could local government have in collecting observations and doing something with the data? • Agreed. We also need new ways of analyzing the data to deal with the spatial disparities in effort (e.g. Stanley park = loads of observations, remote areas = none) • Good workshop topic. • I strongly believe that there is huge potential for this one, BUT there needs to be a serious conversation about developing capacity to support this and identifying bottlenecks within government. • I somewhat suspect the expertise/interest of workshop participants may not align with this, but would STRONGLY recommend it as an area of future investigation. iNaturalist and eBird are incredible resources, but work on **ecosystems** is lagging behind, partly because of the inaccessibility of material on how to identify ecosystems, which is something that should be addressed.
• **QEP[11] submissions:** Explore options for increasing CDC submissions of SEAR point observations and shape files by QEPs (e.g. by making it a mandatory requirement and/or including it in College of Applied Biology (CAB) professional guidance; and by using new technology to streamline reporting process and interfaces)	1		1111	11111111	1111	• Would apply to invasives and fish as well. • Agree to making it mandatory. But CAB-ABCFP already developed a white paper on SAR responsibilities (2009) and QEPs are supposed to report SAR occurrence as part of ethical responsibilities (it's implicit). Issue is private landowner permission. Need to address that. As well what happens when SAR are identified in EA or inventory reports to local govts, local govt staff may not have expertise to know the implications or lack compelling SEAR legislation to do something about it. • It would need to be really easy though or it creates too much of a burden. • this may be our best source of detailed information gathering, compiling it all would be a worthwhile project, and then keep it going • Make data submissions a requirement under municipal development permit, provincial authorizations • Again, **strongly** agree, with the caveat that this would require a serious look at resources available to process this volume of observations, as it could create bottlenecks within

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[11] Qualified Environmental Professional (QEP).

	strongly disagree	disagree	agree	strongly agree	*unsure*	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
						• government. • Consider recent conversation re: funding projects through Genome BC.
• **SEAR assessments:** Develop clear best practices guidance and checklists for site level assessments of SEAR on the south coast (including relevant map layers and mapping standards); and work to have them incorporated into CAB professional guidelines.		11	11111	1111111	111	• Are there any regulations with any teeth regarding species or ecosystems at risk? I feel like anytime they are found, it doesn't matter (particularly ecosystems at risk), unless they're birds and protected under the wildlife act/migratory bird act. • Better understanding of these features is helpful, but only if there is regulation to require their protection • I am not sure that the CAB is the body to do this, it should be tied to Provincial legislation on SEAR, not delegated to professional bodies under the PGA. And not just CAB, it's all of them. • Does this not already exist? If it does not, then I strongly agree it should be developed! • Discussion on this topic should include people working for environmental consultants (not just academics and gov't).
• **Forest ecosystems at risk guidance:** Develop clear guidance on when forested ecosystems are considered to be at risk (in terms of age, structural stage and/or level of establishment, and flood plain forests – to address the issue of many QEPs only identifying 250+ year old forests as being at risk during site assessments)	11		11111	111111	1111	• This already exists? • This is a values-based decision often decided at the municipal or regional level – not sure this would help, but maybe outside municipalities? • Who will impose and monitor this? • I'm not sure if I interpret correctly. If this is about determination of which systems are "at risk", then this is the bailiwick of CDC so collaboration with this group would be great. If this is about providing additional documents to interpret these definitions towards identification in the field or management, this is also really important and I think a great opportunity for collaboration between CDC, LWRS (Churchill, Filatow, others), MoF research ecologists etc. A number of similar documents have been produced in the past and are in play (currently being updated) so it would be good not to duplicate effort or miss opportunities to shift the direction of documents currently being produced to meet the real need being put forward. • Very important that this be addressed. • Potential to discuss at this workshop, though ability to make progress may depend on who is attending.
• **Delineating small wetlands:** Develop a best practices methodology for delineating and assessing small wetlands at the site level.	11	1	11111	111111	111	• Suggest using SHIM mapping standards https://cmnmaps.ca//cmn/files/methods/SHIM_Methods.html • This may already being done by CWS. • I think these sorts of resources already exist, they just need to be standardized and compulsory through the WSA. • LWRS West coast region is working on draft guidance for wetland delineation and wetland function assessment. • Good idea, but this work should be provincial in scope and is in progress. Low-priority for discussion at this workshop. • I believe there are lots of other resources out there from other jurisdictions that need to be carefully considered. • Will probably be done under upcoming wetland work.

	strongly disagree	disagree	agree	strongly agree	unsure	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
• **Marine data:** Work with Pacific Salmon Foundation (PSF), Strait of Georgia Data Centre and others, to explore options for sharing and integrating data, and communicating with their data portals[12].	1		11111111	11111	111	• Also reference BCMCA data https://cmnbc.ca/atlasgallery/bc-marine-conservation-analysis-atlas/ • And reference Marine Reference Guides e.g. https://sogdatacentre.ca/sogmrg/ • Our terrestrial landscape is affected by marine, and vise versa. Yes, planning MUST incorporate these processes if we are to expect any success in the Georgia Basin • To what end? Not really familiar with these data portals.

Culturally Significant Ecosystems

	strongly disagree	disagree	agree	strongly agree	unsure	Comments & Suggestions
						•
• **Intertidal & Estuaries:** Expand SEI classes to include estuaries and intertidal areas[13], which are of particular importance to First Nations.	11		1111	111111111		• This is a gap in our current Environmentally Sensitive Areas mapping – would be great to explore it in more depth • These do exist already (table below) • This would need to be broader than solely for First Nations values. • Agree, but we didn't find it to be an issue. We spoke to the province and they provided us info on estuarine and intertidal classes which we used in the MV SEI. • Consider cross-walking to existing ecological communities, or adding to list of ecological communities to include associations and threats specific to Indigenous use. • Could be part of discussion about relative advantages of SEI vs. TEM.
• **Support First Nations Mapping projects**: Where there is interest, support & resource First Nations' efforts to conduct their own inventory and mapping of culturally significant ecosystems.[14][15]	1		11111	111111111	1	• Essential • Yes, but they often keep their data local/private, so they may not want to make it public at the end of the mapping process so should figure out those terms early on. • Training opportunities, knowledge-transfer, capacity building • Tie to Provincial UNDRIP responsibilities • Would love to see this discussed in the workshop, if there are Indigenous participants or

Embedded table within the Intertidal & Estuaries comments:

ES Estuarine	Ecosystems at marine, freshwater & terrestrial interface; influenced by occasional or diurnal tidal inundation and brackish water.
ES:sp Estuarine:swamp	Treed or shrubby ecosystems with occasional tidal flooding and waterlogged, slightly saline soils.
ES:md Estuarine:meadow	Found in the high intertidal zone of estuaries where tidal flooding occurs less frequently than daily and is tempered by freshwater mixing.
ES:ms Estuarine:marsh	Intertidal ecosystems that are flooded and exposed during most tidal cycles; usually simple communities dominated by salt-tolerant emergent graminoids and succulents.
ES:tf Estuarine:tidal flats	Large flats of silts, sands or pebbles, flooded and exposed in most tidal cycles; macroalgae common.

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[12] See: Salmon Explorer (https://salmonexplorer.ca/#!/), Marine Data Centre (https://soggy2.zoology.ubc.ca/geonetwork/srv/eng/catalog.search#/home), Strait of Georgia Map catalogue (https://maps.sogdatacentre.ca/apps/all-maps/explore) and BC ShoreZone (https://mcori.maps.arcgis.com/apps/Viewer/index.html?appid=c76377500f814914ad90149f229d4d66)

[13] See: Átl'ḵa7tsem/Howe Sound Marine Reference Guide (https://howesoundguide.ca), Strait of Georgia Data Centre and Marine Reference Guide (https://sogdatacentre.ca/sogmrg/), and the Pacific Estuary Conservation Program (PECP) estuary mapping.

[14] E.g. Stó:lō Nation's COVIST Species at Risk Gap Analysis with the Province.

	strongly disagree	disagree	agree	strongly agree	unsure	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
						enough people with the knowledge to discuss it. • Consider how those "culturally signification ecosystems" are recognized and treated in current mapping (e.g., SEI, TEM) as well as policy and legislation. Could be nicely combined with new classification or cross-walking to existing classification.
• **Theming existing datasets:** Where there is interest, explore opportunities for working with First Nations to determine if ecological information in existing spatial datasets can be themed in ways that are more useful and relevant to their interests and objectives[15][16]	1		1111	1111111 11	11	• Essential for many reasons • Use of Realm/Group and Class fields/crosswalking • Tie to Provincial UNDRIP responsibilities • Would love to see this discussed in a workshop, with direct input from First Nations. • Great idea – this aligns with my previous comments about cross-walking where possible (or identifying areas where classifications need to be improved).
• **Formal recognition of high value ecosystems:** If there is interest, work with First Nations to explore options for flagging and formally recognizing at risk ecosystem elements with high cultural value in BC CDC databases[15][17]	1		11	1111111 111	111	• Tie to Provincial UNDRIP responsibilities • Would love to see this discussed in a workshop. • Consider scope/intent of CDC database vs. other databases, and how to appropriately handle this type of information.
• **First Nations led SEAR assessment and stewardship:** If there is interest, explore opportunities to support and resource First Nations in flagging, assessing and undertaking stewardship of culturally important ecological communities at risk[15].		1	111	1111111 111	11	• Tie to Provincial UNDRIP responsibilities • Would love to see this discussed in a workshop. • Could integrate well with above topics about cross-walking to other existing datasets.
Carbon Storage						•
• **Above ground biomass:** Develop a highly accurate above ground biomass layer for the south coast region, based on lidar and ground plots.	1	11	111 11111	11	1111	• Dependent on application but mainly needed for private land. • Only because this is a potential source of funding from organizations like the ECCC • Lots of existing models (Federal, provincial, Regional – e.g., Metro Van, private/NGO sector). Need to standardize existing, don't need to reinvent the wheel. • It would be helpful to have more detailed carbon storage info. Definitely need better soil carbon info too. • As part of my NSERC discovery grant, my team is planning to do this using LiDAR (Tara.Martin@ubc.ca) • I could see this being useful for prioritizing areas for conservation, but it's not my area of interest/expertise.
Watershed Resilience						•
• **Drainage**: Derive a digital elevation model using lidar, to accurately identify watercourses, drainage/relief,	11	1	111	1111111 1	111	• DEM resolution is critical to detect possible water courses in low gradient areas • Flow accumulation models based on DEMs are great, but require a lot of ground truthing to

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[15] In accordance with strict protocols for consent, vetting, and guarding confidentiality of data.
[16] As per work being done by Province with First Nations in the Great Bear Rainforest and on the Sunshine Coast with Sechelt Nation.
[17] Ecosystems at risk that are in poor condition may still be valuable to First Nations, but are not flagged as such in BC CDC database.

	strongly disagree	disagree	agree	strongly agree	*unsure*	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
floodplains and watershed boundaries						confirm accuracy and often miss ditches and other "flatter" features. Useful as a conservative trigger to get QEPs to a site to confirm for development. • Need to coordinate with other efforts before looking to derive this from scratch. Are existing DEMs (and methodologies) not at an appropriate resolution? • I think we have a lot of this through local govt and Regional district ISMPs and watercourse mapping. Compile existing and create a seamless layer, then determine where it needs to be updated or corrected. • Watershed management and improved watercourse mapping is highly desirable on the Sunshine Coast. • we somewhat have this from the province's lidar from a few years ago but it's not always easy for people to access and we've had some technical issues with it • and wetlands • Good watercourse data is definitely needed. • Sounds worthwhile, though this is not my area of expertise.
• **Site level watercourse mapping:** Continue to rely on boots-on-the ground methods to map drainage and watercourses in areas with flat topography (e.g. in the Fraser Valley, where Lidar cannot distinguish watercourses and ditches from roads etc.)	11		111111	11111	1111	• Suggest using SHIM mapping standards https://cmnmaps.ca//cmn/files/methods/SHIM_Methods.html • Note SHIMobile methods https://cmnbc.ca/atlasgallery/shimobile/ • Not necessary for regional planning – generally understood locally by e.g., stream keepers and others • Having a way to incorporate this mapping/ground truthing in provincial/municipal data sets would be great • To quality assure the above process • Not my area of expertise.
• **Topographic riparian mapping:** Extend and enhance wetland and riparian area mapping using new BC-wide topographic riparian area mapping and wetland mapping, produced by Canadian Wildlife Service and The Nature Trust of BC.	1	1	1111111 11	11	1111	• Identifying wetlands in coastal BC forests is far more difficult than other regions of Canada and in agricultural dominant landscapes. CWS methods for identifying wetlands in Canada cannot be used effectively in BC. High resolution DEM derived from LiDAR combined with ground GPS verification is likely the only effective method. • Sure, make all data and their explanations/assumptions available, in part so they can be evaluated for their usefulness: i.e., do any decisions potentially change? If not, usefulness should be questioned. • Is this tied to the one labelled as "drainage"? • Not sure what extend and enhance is suggesting here. • Depends on scale and detail. Need to see it. • Don't know much about this but would like to learn more. • I don't know much about this but it sounds great. • Important work, and I believe this will be undertaken as part of new 5-year program to improve wetland mapping in BC.
• **Hydrologically sensitive areas:** Work to collaboratively build agreement on what ecosystem variables are 'hydrologically sensitive", then develop a mapping layer from these variables, using lidar digital		11	1111111	111111	11	• Fine mapping scale is critical to deriving a useful mapping layer. • There appears to be several ways to identify sensitive areas (based on different perspectives). Would need more info to understand what is being suggested here. • This seems redundant with a lot of the other proposed layers.

	strongly disagree	disagree	agree	strongly agree	*unsure*	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
elevation models, TEM, terrain mapping, climate data, etc. (e.g. riparian areas, wetlands, watercourses, spawning lines, alluvial fans, fluvial sediments, floodplains, karst features, unstable terrain, vulnerable groundwater rain-on-snow zones, etc.). •						• Great idea, that I believe does not receive enough attention. What is meant by 'ecosystem variables'? • Consider how this might be integrated with climate refugia analysis mentioned in another section. • Note that this could be used for ecosystem risk assessments.
Wildfire Resilience						•
• **Fuel mapping:** Explore options for using lidar to improve mapping of fuels and wildfire risk mapping.	1	1111	1111	111	11111	• Pretty obvious already • I think there are other groups focusing on this. There may already be a provincially based layer. • Compile existing data from various jurisdictions first to see where gaps are. • we don't have a lot of info on this currently • This is part of my current NSERC • Not my area of expertise, but this is already being done in government, I believe. Seems like management options available may not warrant a large amount of effort on this.
Cumulative Pressures						
• **Aquatic ecosystem-based approach:** Explore options for coordinating with Pacific Salmon Foundation (PSF) on the methodology[18] and interface[19] they use to rank and portray cumulative pressures on south coast watersheds			1	11	11111 11111 1	• PSF methods employed for Pacific Salmon Explorer are "overview" determinations and don't have fine, detailed data needed for understanding first order watersheds. • Coordinating marine/terrestrial critically important • How does this correlate to other watershed stressor mapping, ISMPs etc.? • Not my area of expertise.
• **Cumulative landscape disturbance approach:** Look at other options for tracking cumulative impacts, such as the cumulative landscape disturbance approach used for Blueberry River First Nation Territory.[20]			111	111	11111 11	• Also review Howe Sound Cumulative Effects Project • https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/cumulative-effects-framework/regional-assessments/south-coast/howe-sound-cumulative-effects-project • So many of these are one-offs not validated, one can't comment usefully unless already intimately familiar with 'cumulative effects' mapping – which is extremely well-developed in Lit. • Other options implies there are current methods? • Province has been doing cumulative effects mapping and monitoring, other jurisdictions, FNs and NGOS have been doing it as well. Need to look at what is out there first. Fill gaps. • Would like to hear more. • We are using Bayesian networks to map and predict cumulative effects in the CDF as my part of my research on CE

[18] See: https://salmonwatersheds.ca/libraryfiles/lib_475.pdf (p.44); methodology incorporates several cumulative effects indicators used in *Interim Assessment Protocol for Aquatic Ecosystems in British Columbia* (MOE 2020) https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/protocols/cef-aquatic-ecosystems-protocol-dec2020.pdf

[19] See; https://www.salmonexplorer.ca/#!/vancouver-island-mainland-inlets

[20] See: https://davidsuzuki.org/wp-content/uploads/2017/09/atlas-cumulative-landscape-disturbance-traditional-territory-blueberry-river-first-nations-2016.pdf

	strongly disagree	disagree	agree	strongly agree	unsure	Comments & Suggestions *(also please indicate if you wish to see recommendation explored in group sessions at Oct 24th workshop)*
						• Seems worthwhile, but see earlier comments: tracking impacts is necessary for effective conservation but does not necessarily lead to it.
Policy, Awareness & Capacity						
• **Policy support & guidance:** Support mapping with boilerplate policy text and guidance suitable for inclusion in planning documents (eg. OCPs, EDPAs, etc.).	1		111111	11111	1111	• This is what's needed. We have the data, we need to convey understanding and application, given diverse socio-ecological goals • I'm not sure if it has "boiler plate text" but the Green Bylaws Toolkit has lots of great information on these https://stewardshipcentrebc.ca/PDF_docs/GreenBylaws/GreenBylawsToolkit_3rdEdition_2021.pdf • If this would be used/useful to implementation of OCPs, etc. then yes. Do we know if boilerplate policy text is specific enough to get appropriate use by local governments? • Good idea. Do you have particular mapping and boilerplate policy text in mind, or does this need to be developed?
• **Capacity building:** Seek opportunities to build capacity of First Nations, local governments and ENGOs to use mapping layers, through training and mentoring (e.g. SEI vs TEM, navigating map codes, etc.)	1		11111	1111111	111	• This is whats needed. We have the data, we need to convey understanding and application, given diverse socio-ecological goals • Capacity yes, for FNs and NGOs, but it's a management/elected official gatekeeping issue for levels of govt (other than FNs), not necessarily a capacity issue. • I think some of this work is ongoing/underway but can always be improved.
• **User friendly products and interfaces**: Explore options for developing a more user friendly interface for accessing a key set of pre-themed map layers, with user-friendly methods for accessing and downloading the layers and metadata[21].	1	11	1111111	111111		• The BCMCA is a good example of this https://cmnbc.ca/atlasgallery/bc-marine-conservation-analysis-atlas/ • This is whats needed. We have the data, we need to convey understanding and application, given diverse socio-ecological goals • This could benefit our land use planners • May be useful but who will warehouse and update it (Province, regional districts, Community Mapping Network)? • There are already multiple user-friendly interfaces available e.g. iMap, CDCiMap, municipality mapping. More important to refine and improve the layers that go into these interfaces and foster consistency among interfaces. • I think this is underway/ongoing, but perhaps this point is suggesting we do more in-depth assessment/surveys of user-groups and focus-groups to determine what they want/need?
• **Awareness:** Raise awareness of relevant mapping layers and datasets, where to access them, how and when to use them, and how to contribute to them.	1		1111111	1111111	1	• Not sure what this means. • Ongoing. Hard to disagree that this could always use more work. I would call this lower priority for the moment, because there are a number of issues with the current systems that need to be worked out before existing mapping can handle a high level of contribution/use/scrutiny.
Additional Recommendations						• I have highlighted a few areas that my team is working on as part of our cumulative effects work in the CDF. Contact Tara Martin

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[21] Similar to the Stó:lō Connect platform (https://thestsa.ca/stsa-operations/prro/stolo-connect/)

END NOTES:

[i] From: Standard for Terrestrial Ecosystem Mapping (TEM) - Digital Data Capture in British Columbia

Minimum Feature Size: The generally accepted minimum size of polygon and line features is related to the scale of data capture. In the coverages these will be translated into ground coordinates. The generally accepted sizes are:

Table 3-14 - Minimum polygon size

Data Capture Scale	Minimum Area (page units)	Minimum Area (map units)
1:50,000	0.5 sq cm	12.5 ha
1:20,000	0.5 sq cm	2 ha
1:10,000	0.5 sq cm	0.5 ha
1:5,000	0.5 sq cm	0.125 ha

Exceptions to the minimum polygon size include small islands and lakes originating from the basemaps and should be approved by the Quality Assurance Staff and Protocols from the Ministry.