COMMENTS BY WILDLIFE CONSERVATION SOCIETY CANADA

ON

Environment and Climate Change Canada's Proposed

"Management Plan for Baikal Sedge (*Carex sabulosa*) in Canada"

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INTRODUCTION

This document is the response by Wildlife Conservation Society Canada (WCS Canada[1]) to the federal government's request for public comments on the Proposed Management Plan. We thank Environment and Climate Change Canada (ECCC) for the opportunity to comment and put forward our perspective. Collectively, we address this issue with backgrounds in conservation of species at risk in Yukon and other jurisdictions, the scientific modelling of the projected distribution of the species in question under climate change, and the assessment of the species in question with regard to the Key Biodiversity Area initiative funded by ECCC.

COMMENTS

We have organized our comments in this document to follow the format of the Proposed Management Plan, referencing section (bold type) and line number. Our recommendations are in bold and italics.

Acknowledgements

94 Affiliation of Linda Pringle seems incomplete

[1] WCS Canada is a national nongovernment organization of scientists conducting research on species and ecosystems to inform conservation decisions. Our role is to provide long-term, site-based, research and syntheses of science that inform policy and practice and that support the implementation of effective conservation measures. We do this by providing technical advice and by engaging relevant decision-makers at all levels, from local to federal. WCS Canada scientists have been working in Yukon since 2004 on land use and protected areas planning, land and water management, wildlife conservation research, and policy applications for conservation science.

1. COSEWIC Species Assessment Information

167 Under "Reason for Designation" in this text box in the Plan, it states that "Since the last assessment, ….two serious threats have been negated…". First, this doesn't seem factually correct, because this section of the last COSEWIC Status Report (2016) had exactly the same text, presumably in reference to the 2005 Status Report. Second, what were those threats? Without knowing what they were, it is difficult to interpret how "serious" they were, and whether they were negated, and what we can learn from whatever happened to negate them.

We recommend that this Management Plan explain what the two negated threats were, either in this text box or later in the Threats section.

3.2 Species Population and Distribution

198 The title of this section uses the word "population", without defining what is meant. Subsequently the word "sub-population" is used repeatedly, as is the word "site". This is potentially confusing. First, it is not clear that all the sites at which this species occurs in Yukon can be considered collectively as one population; the likelihood of genetic exchange among them all seems very low though some sites are close enough to each other (with conceivable mechanisms of exchange of one or more life history stage) for reasonable chance of genetic exchange (e.g., Dezadeash, Champagne, Alsek).

It seems more likely that there are a number of different populations of this species in Yukon, a question that deserves attention in terms of the relative value of each of the sites.

The term "sub-population" seems to be used interchangeable with "site", but that it not explained.

We recommend that this section provide more clarity on the use of the terms "population", "sub-population" and "site", and also acknowledge that there is strong likelihood of different effective populations of this species within its Yukon distribution.

225 Figure 3. The top panel in this figure is blurry and needs to be higher resolution for good interpretation. Also, the open sand landform at the north end of Sekulmun Lake is not included on this map. Is that an oversight? Also, the Geological Survey of Canada reference is incomplete; ideally a map should provide the data sources.

242 The term "Indigenous land claims" is not specific enough to attribute land ownership. All Indigenous land claims in the range of this species in Yukon have been settled; they are no longer just claims. Those settlements have resulted in some fee simple land ownership on the part of individual First Nations (i.e. R-blocks or "settlement lands"). Presumably, the text is referring to these R-blocks, and more accurate wording would help.

4.1 Threat Assessment

Table 2

Section 11 dealing with Climate Change is mixing two different processes in one row of the table, and, as a result, is not entirely accurate. It is also missing an important process – wind, and an aspect of precipitation increases.

The two processes being mixed in one row are temperature increases and precipitation increases. The two "detailed threats" currently provided as examples reflect this difference in process, and deserve different Scope, Severity, and Timing ratings. Precipitation increases *may* promote growth of plants moving into dunes from edges and stabilizing the dunes (as the Table suggests, but see comment below at line 439). That process seems to be driving the Pervasive rating for Scope, and High rating for Timing. By contrast, temperature increases have driven the relatively rare, river piracy at the outflow to the Kaskawulsh glacier; this phenomenon does not deserve a Pervasive rating for Scope as it threatens the integrity of just the Alsek sites, and is not likely to occur at other sites.

There is another mechanism whereby increased precipitation (snowfall) can be a threat, and it works in the same fashion as Threat 7.2 – Dams and water management. It is summer and autumn high flooding levels in the Marsh-Tagish-Bennett Lakes system, as a result of unusually high snowfall events that may become more frequent. The result is reduced duration of extensive exposure in the ice-free seasons of shoreline sands to wind (e.g., Bennett Lake at Carcross Dunes). This process needs to be itemized and discussed.

Thinking comprehensively, a combination of increasing temperatures and precipitation characterise climate change in this region. The net effect may be similar to that already brought forward about encroachment (but see row 439 below), so perhaps it could be merged with the row on precipitation increases and encroachment.

Also, this assessment of climate change does not address wind. A number of the sites supporting this species are maintained as active dunes by katabatic winds. Such winds depend on a strong temperature differential between cold alpine areas and warmer adjacent valley bottoms. There is risk that the strength of these katabatic winds will diminish with the more rapid melt of snow in alpine areas, and the loss of permanent alpine snowfields. This threat does not hold for all sites (it is most prominent for Carcross and perhaps Kusawa/Takhini), and it has a longer time horizon.

This assessment does not address fire, which has some likelihood of increasing in frequency and severity in this region. This may be seen as irrelevant, as it may not be threatening to dune ecosystems (low likelihood of travel through the dune vegetation) and may remove encroaching vegetation. However, it is worth mentioning because prescribed fire could be used as a means of curtailing some forest encroachment on dunes (i.e. reversing another threat which is fire suppression).

365 Assuming that the text's use of "snow machines" refers to "snowmobiles", we suggest changing "snow machines" to "snowmobiles" for consistency with the rest of the document.

377 "wil" should be "will"

398 The use of pers. comm. is best avoided in documents such as this Management Plan because such a reference cannot be validated by the reader, and because this document has close to regulatory status. There is likely a published scientific reference or map source for this information on Holocene dunes. For example, some surficial geology mapping is available at: https://yukon.maps.arcgis.com/apps/webappviewer/index.html?id=03822dfebcd34484a0c75faf907dee60 . This general reference to sand-rich landforms is supported adequately by reference to Bond et al. 2004 Surficial Geology in Smith et al. Ecoregions of the Yukon Territory. Also, the maps in Figure 3 include spatial information on sand dunes across Yukon; that information is referenced to Geological

Survey of Canada (GSC) in that Figure (without a complete reference), and it seems that the GSC reference could also apply to this section of text.

At the very least, reference to an individual should have text explaining the person's expertise and authority (e.g., in the References Cited).

413 Once again, the use of pers. comm. is best avoided in documents such as this Management Plan. In this case, it seems there is no need for this reference to a communication from Bennett because the Recovery Team document, already referenced, is sufficient reference.

422 Threat 10 is itemized and discussed here, even though it is rated as Negligible Impact. This contradicts statement at line 302 indicating that only threats with Low or Unknown Impact would be discussed.

435 This section on Threat 11: Climate Change would benefit from much more detail and thought as to the variety of potential changes that climate change could bring. As indicated in our comments regarding Table 2 (above), there is much more to be discussed.

439 The text states that climate change will bring warmer and wetter conditions to southern Yukon. First, this statement should be referenced. Second, it is not clear why such changes will threaten this species or dune environments. The text needs to lay out the mechanism(s) that would lead from changing temperature and precipitation to loss of dune habitats. For example, the majority of the warming has been, and may continue to be, in winter: does that affect the sedge? Increased precipitation in summer, with warming, may be expected to enhance encroachment by other species into dunes, that tend to be water limited sites for many plants. But increased heat can offset increased precipitation, by means of increased evaporation, especially if the precipitation is pulsed and not regular in occurrence. It seems that the assumed mechanism(s) for this threat need reference, and/or the mechanisms and outcomes need to be laid out as a hypothesis to be investigated.
We recommend that the text provide more detail and references on the various mechanisms whereby changing climate may influence growing conditions for this species and may influence the dune landforms.

449 **Limiting Factors**

The text of this section would benefit from some more detail. First, earlier discussion of reproduction (starting line 261) included data on low production of fruit, and high sterility of fruit produced. This warrants more attention and explanation in this section. At first thought, those data suggest that a lack of sexual reproduction might be a strong limiting factor. How is this plant pollinated? Is there likely to be low fruit production and high sterility in such a clonal plant, with high potential for self fertilization? Does fertile fruit depend on cross-pollination between clones? Figure 1 refers to balloon-like structures covering the developing seeds. What is the supposed purpose of these structures, and do they form on all seeds or all fertile seeds?

Second, many graminoids are limited by herbivory. Is herbivory, by vertebrates or invertebrates, a prominent process for this species? Some mention of this seems necessary.

456 The text regarding the Meloni et al. study needs to be more detailed to put across the full meaning of that study, and to avoid the conclusion that low genetic diversity in this species is of no conservation concern. The reader can come to that conclusion based on the text as written.

The theoretical and real-world information in that study illustrate that clonal (i.e. vegetative) reproduction can enhance genetic diversity *(i) within a single population of a species under stress, and (ii) if that population already has a number of clones of differing genetic composition*. The mechanism is that clonal reproduction results in higher chances of new individuals (ramets), of each clone (i.e. genotype), becoming established than does sexual reproduction; consequently, the initial genetic diversity is more likely to be maintained through time. However, that study also points out that relying only on clonal reproduction is ultimately an evolutionary dead-end. That is because, by chance alone, some clones will go extinct (leaving a monoclonal local population), and, in the absence of sexual reproduction, new clones will not be established. This means that we need to know how close existing populations (sites) of this species are to being monoclonal, and what are the details of and limiting factors for successful sexual reproduction.

We recommend more thorough discussion of this situation, the literature referenced, and what it means for the research agenda.

465 Change "affects" to "effects"

5 Management Objective

The only management objective listed is persistence of all extant subpopulations. This is certainly the most important Objective, at least in the short term.

However, various threats seem likely to change the value of currently occupied habitats over time, as indicated in this proposed Plan. Recent modeling[2] of the potential future distribution for this species under climate change indicates that much of central Yukon could well support this species, at least in terms of future climates, by the middle of the century (see our Figure 1 below). This suggests a reasonable likelihood of successful survival in the sand dune complexes identified in central Yukon (Pelly Crossing region) on the map (Figure 3) in the draft Plan, or at the north end of Sekulmun Lake, where active dune features exist

So, we suggest that this Management Plan should include a second Objective which would be to explore the possibility of establishing new population(s) of the species in presently unoccupied sand dune(s) of central Yukon. Such an Objective would require various activities, including experiments within existing sites to translocate individuals (roots and rhizomes) to understand necessary practices, attempts to raise new individuals from seed, and ideally a better understanding of genetic diversity within and among subpopulations. In addition, these activities, accomplished *within* existing sites, could conceivably be used to help maintain site-specific genetic diversity through establishment of replicates of existing clones and/or of new clones.

[2]Oke, T.A., Stralberg, D., Reid, D. G., Bennett, B.A., Cannings, S., Willier, C., Cooke, H.A., Mantyka-Pringle, C.S. Warming drives poleward range contractions of endemic species at high latitudes (in review in Diversity and Distributions)

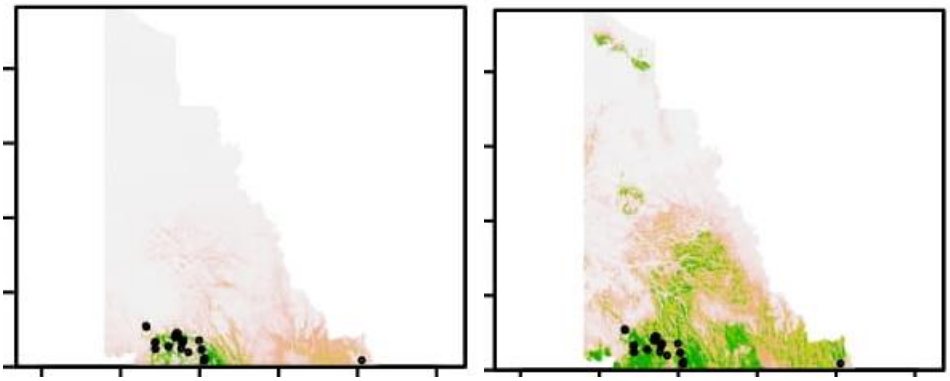

Fig. 1 Projected current (left) and future (by the end of 2040—right) for Baikal sedge. The current projection was generated using the 1970 – 2000 historic climate baseline while the future projection was generated using CNMR-ESM2 General Circulation Model under the intermediate socio-economic pathway (SSP2-45). Black dots are currently known sites with this species.

We recommend that the Management Objective be expanded to include a more forward-looking view on adaptation to threats, including climate change, by including preparation for and experimental implementation of the establishment of new local populations to increase the chances that the species can withstand change.

6.4 Conservation Measures

584 **Land Management**. This section would benefit from more thought on its structure and content. At present it mixes and matches three main concepts – degradation, restoration, enhancement – within each of the paragraphs, and there is not a clear set of messages. It mentions a fourth concept – irreparability – but provides no insights into how, where, and by whom such decisions would be made. It also needs to reference the fact that another key conservation tool – protection – is dealt with under a different Strategy – Conservation designation (below).

This land management section could be structured around the key threats – all-terrain vehicles, exotic invasives, and stabilization. Within each of these, the processes in question (and their relationships with degradation, restoration, and enhancement) needs to be outlined. For example, how could all-terrain vehicle use actually be managed? One tool available to government is the creation of Off-Road Vehicle Management Areas (Territorial Lands (Yukon) Act – soon to be revised). This requires a body, such as a land use planning process or a Renewable Resources Council, to put together an application for such designation (This approach might fit better in the next Strategy, yet would need to be mentioned here). ORVMAs do not deal with snowmobiles. Apart from zoning and designation, there are no land management tools available to deal with this threat on public lands: ORVs can go anywhere, as long as they do not cut forest trails more than 1.5 m wide (and that doesn't pertain in a dune situation). The lack of tools for this threat needs to be emphasized, and areas with irreparable damage and species loss need to be identified.

Invasive species pose two threats – competition and stabilization. Each needs to be addressed. The main tool would be physical removal, and the text can be more detailed on how and when to do that.

Stabilization also requires active intervention, but how? One tool could be prescribed burning to kill off trees and shrubs and ground cover encroaching on dunes. Although this is unlikely to happen close to human settlements, it could be experimentally applied in a number of more remote sites (Dezadeash, Taye, Kusawa-Takhini).

600 **Conservation designation**. This section deserves considerably more thought and detail. Zoning is mentioned, but zoning for what? Presumably this refers to establishment of zones, in land use plans, that provide complete protection for habitats. What legislative tools can do so? Many of the zoning designations, under the Parks and Land Certainty Act or the Wildlife Act, cannot keep Off-Road Vehicles out, unless specifically regulated in the Plans (e.g., Ddhaw Ghro HPA Management Plan). This needs to be explicitly pointed out. This is where the ORVMA concept under the Territorial Lands (Yukon) Act needs to be laid out.

What land uses would be regulated under zoning designations – just ORVs or also other recreational activities, as well as more intensive residential and industrial developments?

This section would benefit from pointing out that Yukon lacks any legislation or regulatory tools for protection of small-scale critical habitats of species at risk; efforts need to be made by the federal government to lobby for such designations in territorial legislation such as the current revisions to the Lands Act. ORVMAs can do so for protection from ORVs, but at landscape scales (i.e. whole dune systems, rather than small-scale sites). The most effective approach using ORVMAs would be to get all dune complexes in the territory designated at once.

We recommend revisions to this section to more completely address the legislative and regulatory possibilities of some forms of land use zoning, and the gaps in the current options available.

605 **Raising Awareness** We agree that raising awareness through various mechanisms will be useful and necessary, and that a whole dune ecosystem approach is required.

615 **Research and monitoring**. This section could do with some more clarity. In the first paragraph mapping of distribution at very different scales is mixed up – “distribution of all occurrences” and “precise counts of all ramets”. These deserve separate paragraphs and explanation as they are very different in approach.

Mapping of all ramets, in a detailed Cartesian coordinate system, is one way to either keep track of local population size (monitoring) or assess stabilization. We suggest that fixed linear quadrats or transects, with ramets recorded as to position along the transects, perhaps using distance sampling, would be less time-consuming and costly. Though it would not produce a complete census, it could produce population estimates with enough precision to monitor trend. We also suggest that stabilization of dunes, and encroachment by woody vegetation, would best be measured using repeat satellite imagery.

There is mention of need for research on basic biology, but only low genetic variation and parasitic fungus are mentioned. What actually are the research questions? What about our level of knowledge of reproductive biology, from pollination to cross vs self fertilization to seed set to seed predation to germination?

A number of other general topics are listed, but without specific questions to be investigated. Experiments would help a lot: experimental prescribed fire; experimental removal of exotics and other ground cover.

We recommend that this section be revised to be more explicit and detailed about the questions to be asked, and how they can be addressed experimentally.

7 Measuring Progress

651 Mention is made of "measuring disturbance" at sites. This is difficult to accomplish, and is not mentioned in the Research and Monitoring section earlier in the document. Therefore, without more information and explanation, it is unclear how this could be accomplished. Also, what is meant by disturbance? Some of the mitigation measures mentioned earlier do not deal with what would normally be thought of as disturbance for this plant (i.e. vehicle and person traffic), but instead deal with removal of competitors and species causing stabilization. ***We recommend that the text be more clear as to what is meant by disturbance, and how the full set of threats to persistence might be monitored.***