14 December, 2022

# **Biodiversity Risk Assessment in the Oil Sands Region of Alberta, Canada**

# Presentation notes

### **Slide 1: Introduction**

Hi again everyone. It’s great to be able to do this presentation so early in the project cycle so we can start the feedback process and make sure we’re all going down the same road in terms of understanding the project and what expectations are, and the potential, for developing this research.

### **Slide 2:Roadmap**

I want to start of with a quick roadmap of the presentation so we all know where we’re going with this.

* First, I’m going to set the context by describing how we are approaching this project, and why. I have to admit that I don’t know my audience terribly well, so I’m likely going to be saying things you already know, but I want to make sure a frame this research correctly so that the subsequent parts make sense.
* Second, I want to give a more specific description of what we mean by risk assessment, and talk about why we want to approach it this way.
* Finally, I’m going to try to tie it together by talking about why this approach is so relevant to the decision-making process, because informing on-the-ground decisions is really the ultimate purpose of this research.

### **Slide 3: Climate Adaptation and the R.A.D. framework**

So, the big question facing us here is: how can we best understand and mitigate the risks to biodiversity imposed by oil sands development in Alberta. In the short term and at small spatial scales, we’re mainly talking about habitat changes from disturbances like well pads, roads, and seismic lines. In the long term, however,and over large spatial extents, one of the bigger challenges in answering this question is dealing with the complications imposed by climate change.

* Traditionally, we would have thought about mitigation, restoration, and biodiversity conservation according to historical responses of landscapes to disturbance, and within the context of the natural range of variability for species, ecosystems, and landscapes.
* Because of climate change, however, we can say with a high degree of confidence that ‘The world has moved on’, meaning that things aren’t happening the way they used to.
* The wide-ranging and inevitable impacts of climate change on disturbance regimes, vegetation successional pathways, and species survival and reproduction means that reliance on traditional paradigms in wildlife management and restoration ecology are unlikely to achieve long term, large scale conservation goals.
* Because, as they say, ‘The world has moved on’… and of course, many species and ecosystems are vulnerable to the effects of climate change
* As a result, managers are increasingly shifting to a climate adaptation approach to managing wildlife and developing long-term conservation plans in the face of climate change.

### **Slide 4: Some terms**

As we talk about the context, I want to give specific definitoins for these terms:

* First is Vulnerability, which is the combination of exposure, sensitivity, and adaptive capacity to new conditions brought on by climate change.
  + For example, the boreal forest is warming at a much faster rate than other areas of the globe, meaning that boreal species generally have a higher exposure to climate change than many others.
  + It has been shown that this warming has a big effect on seedling survival and tree growth in a number of boreal conifers, meaning they are highly sensitive when exposed.
  + Finally adaptive capacity is the ability of a species to cope with or adjust to climate change, such as species being able to shift their range or respond behaviourally.
* Second when we say adaptation in this context, we are talking about the intentional adjustment of natural systems to reduce risks from climate change.
  + This is a big topic, but an example of adaptation is planting secondary nectar species to enhance survival of an endangered butterfly,

### **Slide 5: Ecosystem transformation**

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One of the biggest challenges in the OSR is the potential for ecosystem transformations brought on by the interaction of climate change and industrial development.

Historically, ecosystems changed as a result of natural fluctuations in climate and other processes. Human expansion and the development of agriculture added another dimension to these changes. Now, we are seeing the synergistic effects of industrialization and anthropogenic disturbance accelerate the rate of change and create increased uncertainty in future conditions.

In terms of forests: - Globally, forests are becoming younger and more open, and climatic extremes are favoring trees of lower stature.

* Forest tree species composition is trending towards species more tolerant of warmer temperatures drier conditions.

### \*\*Slide \_\_: Changing response pathways\*\*

Now, it is possible for climate change to cause a complete regime shift from forest to non-forest, and shifts like this on a large scale have been predicted for large parts of boreal Alberta, converting it to more of a Parkland ecosystem like we have around Edmonton.

However, in the nearer-term, it is much more likely that we will see response pathways to disturbance that resemble those described by Seidle and Turner, where the forest remains but changes either structurally or compositionally or both.

Essentially, they described 5 different possible outcomes: 1. On the one hand, after a disturbance, a forest could come back essentially the way it was before, what they called Resilience, where the forest follows the historic successional pathway. 2. On the other hand, a forest could undergo restructuring, where it regrows with the same species composition but a different structure, for example trees could be smaller or less dense; or Reassembly, where the structure is the same but the species are different. 3. If a forest changes in both composition and structure, they termed that ‘Replacement’, becasue it is essentially a whole different forest type. 4. Most drastically, an area could undergo a total ‘Regime Shift’, where it is no longer even a forest.

Why is this important? Because if we are going to estimate the risks to species from oil sands development, we have to do so within the context of the primary disturbances and successional pathways within the region. In this case, the major disturbances in the region are fire and forest harvesting, meaning any mitigation strategies must take into account how forests respond to those disturbances under climate change.

And the key factor in planning for this is Uncertainty.

### \*\*Slide \_\_: Defining the problem\*\*

I want to take a minute here to define the problem in using ecological models to predict future conditions, and why we think it’s important to take a risk assessment approach.

But first, we need to explain exactly what we mean by risk assessment.

### \*\*Slide \_\_: the risk assessment approach\*\*

Why use risk assessment?

* we know that the future is uncertain
* the key objective of the risk assessment approach is to develop the tools to formally account for that uncertainty
* the result is that uncertainty can then be incorporated into the decision-making process

### \*\*Slide \_\_: the risk assessment approach\*\*

In describing this approach, I’m going to talk about 2 papers that I think really lay the groundwork for why we should be taking a risk assessment approach, and provide a roadmap for how to go about it.

* the first is a paper in Forest Ecology and Management lead by Colin Daniel at ApexRMS consulting service, where they show that failing to consider uncertainty in the outcomes of ecological processes – in this case wildlifer – means that timber harvest projections are almost always going to be overly optimistic; particularly under climate change.
* the second paper is by a friend of mine form my PhD program named Brian Stevens, where he took a risk assessment approach to the problem of setting turkey harvest regulations in Michigan. The uniqueness of this project was not only the use of risk assessment, but also that they incorporated it into a structured decision-making process with stakeholder input to determine management targets and trigger points for changing management.

### \*\*Slide \_\_: setting management reference points\*\*

* need to define what we mean by ‘sustainable’
* Rather than a traditional population model, we have a SDM that assumes a relationship between habitat and population
* Rather than a harvest dynamics model, we have a model of population response to disturbance that links to the habitat-population model
* Rather than being limited by population assessment, we are limited by our understanding of
* We will use simulations and sensitivity analysis to identify uncertainties that have a large effect on performance measures

### \*\*Slide \_\_: adapting research to the decision-making context\*\*

* Making state-dependent management decisions
* Decide on appropriate performance measures
* making sure that guidance for climate adaptation is constant with the decision space and authority of the decision-makers, as well as the spatial scales at which the changes are occurring over which the managers are operating.

### \*\*Slide \_\_: The critical importance of spatial scale\*\*

### \*\*Slide \_\_: Final Thought\*\*

We can’t really make predictions because we can’t model the system perfectly, and there are too many things we don’t know. There’s just too much uncertainty.

However, we shouldn’t let that stop us from making the best decisions we can based on what we do know or can shrewdly guess.

On the other hand, we shouldn’t pretend we know things we don’t, and make decision based on predictions we know a priori are almost certain to be wrong.

The answer is to explicitly incorporate that uncertainty into the decision-making process, and by that use our best estimates of the risks of various outcomes to guide us through the process.