Farming Futures

User Feedback on the Use of Models and Spatial Tools for Supporting Climate Change Adaptation in Agriculture

Authors

Carina Grajales Veerkamp

Researcher, School of Environment and Sustainability, Royal Roads University

Vali Vakhshoori

Postdoctoral Researcher, School of Environment and Sustainability, Royal Roads University

Robert Newell

Canada Research Chair in Climate Change, Biodiversity and Sustainability, School of Environment and Sustainability, Royal Roads University

Alesandros Glaros

Postdoctoral Fellow, School of Environment and Sustainability, Royal Roads University

Acknowledgments

March 2026

Table of Contents

1. Introduction

This report presents findings from a series of two stakeholder focus groups that examined a model of future agricultural land suitability in British Columbia under different climate change scenarios. The report specifically focuses on challenges and considerations related to the technical aspects of using and engaging with the model data and the data platform (i.e., Agrilyze). Findings specifically related to the application of the model to agricultural planning and policy can be found in this report:

> Vakhshoori, S. V., Newell, R., & Glaros, A. (2026). *Future agricultural suitability models as tools for climate change adaptation in British Columbia*. Transdisciplinary Research on Integrated Approaches to Sustainability (TRIAS) lab, Royal Roads University, & Food and Agriculture Institute, University of the Fraser Valley. https://doi.org/10.13140/RG.2.2.22274.75205

The model uses machine learning and spatial techniques to assess how climate change may affect the agricultural suitability of key crops across British Columbia over the next 75 years. The model applied the Intergovernmental Panel on Climate Change's Shared Socioeconomic Pathways (SSP) scenario framework, focusing on agricultural futures under SSP2, SSP3, and SSP5. The model's geographic focus is British Columbia's Agricultural Land Reserve (ALR), an area protected and zoned for farming based on favourable biophysical characteristics (e.g., soil and climate) and land-use types. Seven focal crops were selected for the analysis based on their economic and dietary importance to residents of British Columbia, the extent to which they are imported into the province, and their potential for cultivation using controlled environment agriculture techniques.

Based on the selection criteria, the model was applied to cabbage, cauliflower, lettuce, kale, strawberry, broccoli, and celery. The study revealed new opportunities for agriculture, particularly a northward expansion in the suitability for growing cabbage, cauliflower, and lettuce. The model also demonstrated losses in agricultural suitability, as seen with strawberry, kale, and broccoli under severe climate change scenarios. Celery demonstrated declines in suitable cultivation area under all climate change scenarios. The model identifies currently underutilized agricultural lands (particularly in the central and northern parts of the province), and it serves as a scalable tool for policymakers to guide strategic land use and climate change adaptation.

The current report presents the results of a qualitative analysis of the focus group data. The focus group participants included farmers, professional agrologists, academic researchers, and government representatives (including the BC Ministry of Agriculture and Food). Participant feedback on the model and data platform grounded this research in professional experience and expert knowledge. The qualitative analysis of the focus group data identified themes related to the model data platform's usability, model validity, and potential applications. Participants valued the model's utility for agricultural risk reduction and investment justification, but also highlighted areas for improving user experience and reducing strategic risk.

2. User Experience

Participant feedback indicates that the model is academically robust; however, issues with the data platform's interface and visual complexity cause frustration. Participants indicated that such frustrations may hinder broader adoption within the farming community.

2.1 Visual and Technical Accessibility

Technical limitations hindered initial access to the platform for some participants. Users specifically reported browser incompatibility issues when using Safari on Apple devices. Additionally, the platform's visual design creates challenges. The map layers use many colour gradients, which some found confusing and hard to read for colorblind users. One participant commented:

"Is there a setting for accessibility, like for colorblindness? Everything is shaded in different colours...Replacing colours with patterns is a simple change that would make it readable for everyone, even those who are colorblind" (FG1, P11).

Figure 1. Current and proposed styles for spatial data in Agrilyze. (a) Current colour gradients flagged as confusing for colour-blind users. (b) Proposed pattern-based visualization
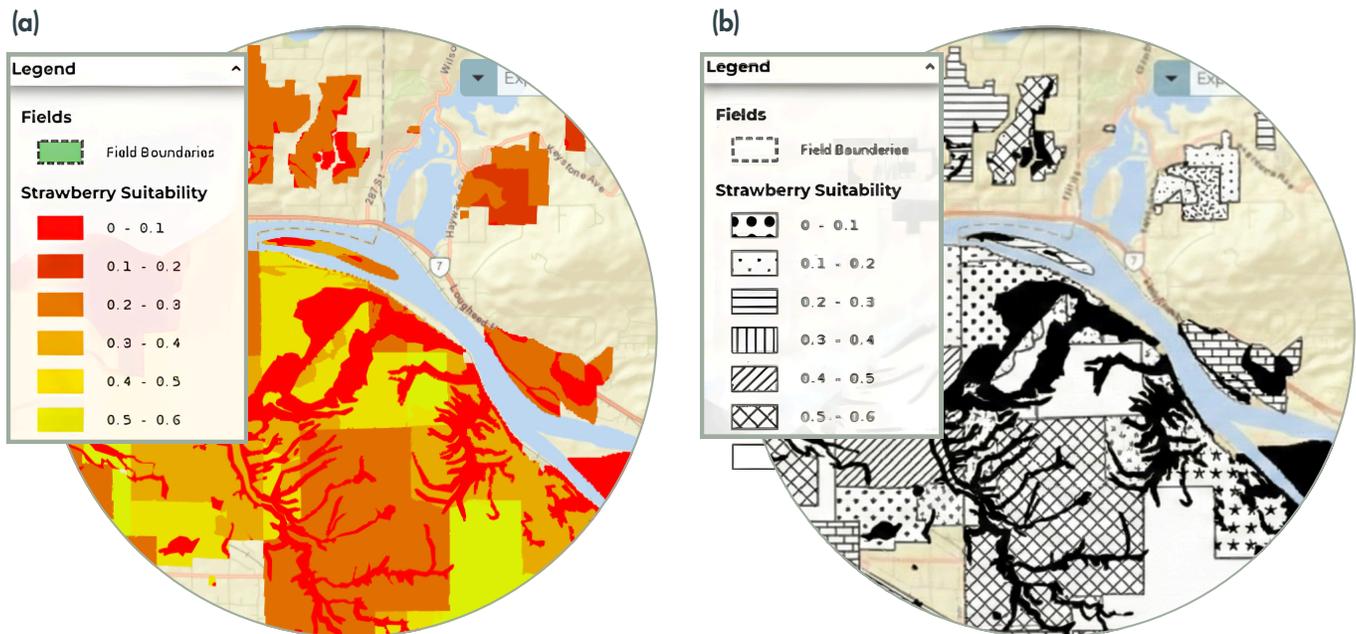
Participants noted that the data platform interface has a large number of options, which can cause visual overload. This can make the platform less accessible to farmers without a technical background in spatial data. Participants emphasized the need to simplify the experience:

"The more simplified you can make it... not have that panel be so busy with all these different options for them to click on" (FG1, P5).

To help with potential issues related to technical expertise, participants recommended creating intuitive onboarding functions, such as adding help icons or user guides embedded into the platform. To reduce cognitive burden, participants suggested curating information for non-academic users by pre-loading a specific climate scenario, such as the "worst-case" scenario, to clearly communicate risk. One participant explained:

"As a scientist, you decide which climate model is the most likely, or maybe you use the most conservative climate model...producers [are] not gonna know what those climate suitability models really mean...and they're gonna be basing their choices off of risk and perceived risk" (FG1, P5).

2.2 Feature Focus: Comparison Slider and Customization

Participants commented on the Agrilye's comparison slider, identifying its value for enabling direct visual comparison of spatial scenarios and observing how agricultural suitability may evolve over decades. However, its current functionality was noted to be confusing. Users struggle to determine the map layer's orientation. This confusion was articulated by one participant's question:

"How do you know which side is on the left and which side is on the right?" (FG1, P10).

Figure 2. Screenshot of the time slider being used on the agricultural suitability data. Users had difficulty determining the placement and positions (i.e., left or right) of the map layers
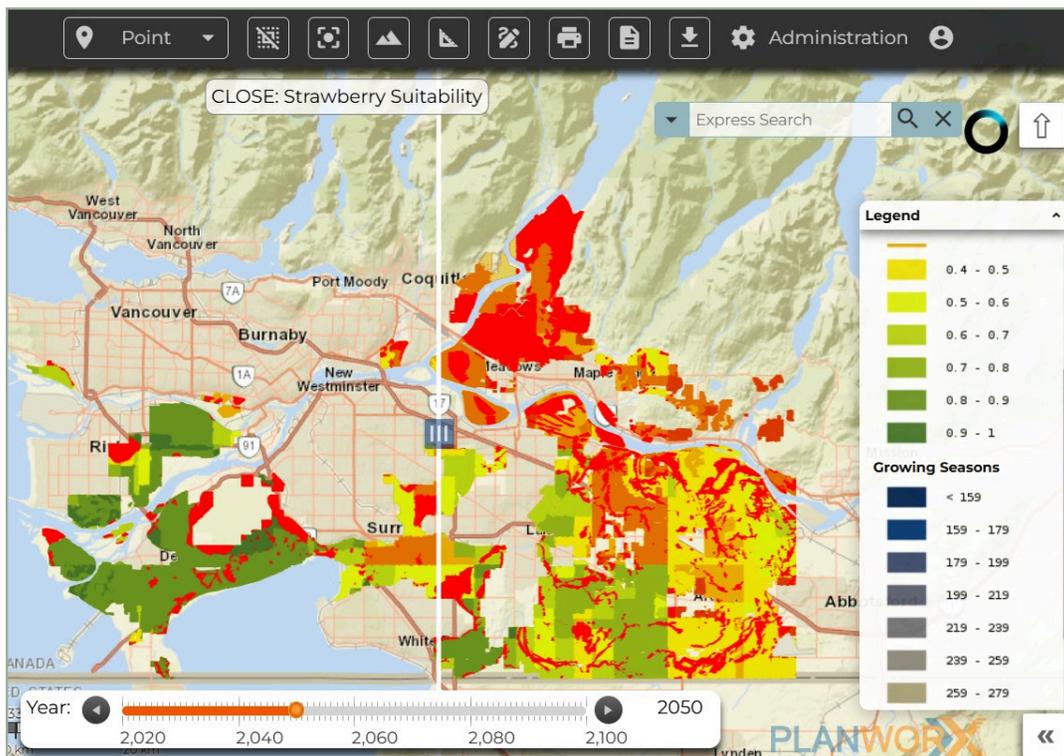
A demand for greater platform flexibility in crop parameters was expressed. Because different crops and specific cultivars respond differently to climatic and environmental conditions, users expressed a need for customizable inputs rather than relying solely on static, pre-defined models. This need was clearly articulated by a participant requesting a more adaptable and interactive tool:

"I was also wondering if you could have a custom suitability setting where you could actually put in a different crop and adjust some of the parameters of the specific species" (FG1, P3).

3. The "Viability" Gap: Economics and Operations

3.1 Economic Indicators and Supply Chain

Participants made a clear distinction between climate suitability (agricultural potential) and actual economic viability. Climate suitability is irrelevant if a crop is not profitable. Users suggested integrating economic indicators, including production costs, expected yields, and local supply-chain infrastructure such as processing and transportation, noting that yield is highly dependent on access to transportation and packing plans. One participant commented:

"Something that I think would be useful to add is the cost of production in different parts of the province… and what kind of yields could they expect" (FG1, P5).

3.2 Local Variability and Biophysical Constraints

Participants explained that models developed at regional scales often fail to capture the local-scale variability and contextual factors that shape actual growing conditions. Location-specific differences in topography, hydrology, and microclimates can substantially alter agricultural potential, even between neighbouring properties. As one landowner participant explained:

"I understand that my property is in a very specific kind of microclimate that's probably not gonna get captured in the broader modelling. For instance, I have a much shorter growing season than the people surrounding me because I'm in the bottom of a bowl…I get all the frost drainage down in here" (FG1, P2).

Crop suitability is influenced by multiple biophysical variables beyond temperature and precipitation. Participants identified soil characteristics, such as salinity, nutrient availability, and pH, as being critical factors that can inhibit agricultural success even when climatic conditions are favourable. One participant expressed this limitation:

"Sure the climate's great, but the soil is too salty or the pH is all wrong…here are other variables besides temperature and precipitation that dictate what you can and can't grow" (FG1, P5).

Additionally, participants noted the temporal disconnect between rapid climate shifts and slow soil development. One participant explained:

"Temperature changes quickly...but soil doesn't develop that quickly....looking at the map by temperature, it looks like you could grow a lot more, but the soil is not actually going to keep up" (FG2, P1).

The lack of granular environmental data also extends to water licensing and irrigation access. Users stressed that the future agricultural opportunity areas predicted by the model are effectively meaningless without considering hydrological constraints. As participants identified, it is difficult to evaluate future potential without discussing irrigation:

"access to irrigation is a huge factor for what can be grown" (FG1, P1).
"it's almost like sure it's suitable to grow lettuce, but there's no water" (FG1, P5).

The omission of key biophysical factors in the model, combined with the model's geographic focus on the ALR, resulted is discrepancies between modelled agricultural suitability and observed agricultural activity. Participants observed that crops currently grown and sold locally failed to appear in the suitability outputs in some areas. Such comments highlight a need to groundtruth models via real-world farming experiences. One participant shared:

"You go to the farmers market, and there's cabbage every weekend… cabbage and broccoli and strawberries, and none of those are showing up on the map. So, I understand there are some limitations to this… my farm's not actually in the ALR, so it doesn't exactly show up on your map" (FG2, P4).

3.3 Expanding Scope and Risk Assessment

The reliance on annual climate averages blurs vital seasonal dynamics, particularly expansion opportunities during the shoulder seasons (i.e., spring and fall). Participants recommended capturing seasonal dynamics and opportunities. One participant commented:

"That's part of the challenge of this type of modelling, it's all averages. So you don't get to think about the shoulder seasons or the different times of day" (FG1, P3).

Participants also recommended integrating extreme event risk modelling, including heat domes, flooding, and wildfires. One participant inquired:

"I'm just wondering what the capabilities are to interject extreme events into this" (FG2, P8).

Participants recommended expanding the model's scope to include livestock and perennial crops, such as tree fruits, which involve high upfront capital costs and long-term investment horizons. Some participants also identified that the model currently excludes on-farm adaptation measures that mitigate climate stress, such as light crop coverings like hoop houses or row covers:

"So it doesn't take into account any sort of kind of light crop covering, say like a hoop house or a row cover..." (FG1, P1).

4. Platform Applications and Knowledge Translation

Participants identified multiple applications for the model, describing it as a potentially useful platform for planning, communication, innovation, and collective learning. They also expressed caution about its potential misuse in land use decisions.

4.1 Knowledge Translation and Regional Summaries

To bridge the gap between complex scientific modelling and practical on-farm implementation, participants emphasized that raw map data must be translated into actionable insights. They strongly recommended adding a platform feature to generate "regional summary reports" that synthesize trends and reduce the burden of interpreting individual maps. These summaries would provide producers with a realistic planning horizon. One participant explained:

"For a producer…maybe they're thinking right now, what am I gonna plant next spring? I feel like something that would be really helpful is to take this information and try to generalize it by region for the next 10 years…and that becomes a resource so that each person isn't trying to interpret this map again and again and again" (FG1, P5).

Participants also emphasized the need for transparent communication regarding data uncertainty. While the model's overall accuracy may be high, local inaccuracies pose a significant risk to farmers making planting decisions. One participant suggested visually communicating this risk on the maps:

"let's say somebody looks at you know lettuce and it says it's suitable, but actually in that particular location, the accuracy wasn't that great... Is there a way to put like hash marks over it or something and be like, this is risky?" (FG1, P5).

4.2 Strategic Planning, Storytelling, and Collaborative Research

The model and data platform were regarded as valuable tools for reducing business risk and justifying funding. Participants noted that the model provides evidence to justify applying for funding for crop diversification or new technologies. The spatial visualization of future agricultural suitability can build confidence for trying new agricultural practices, approaches, and techniques.

Participants advocated for expanded definitions and understandings of "agri-tech" in funding programs. Specifically, participants emphasized that financial support should be provided to farmers who wish to experiment with low-tech, locally adapted solutions (such as shade cloths and tunnels), rather than solely high-tech practices like vertical farming.

Participants indicated that the model and data platform have significant potential for knowledge mobilization. Participants highlighted the platform's capacity for place-based storytelling, which can render abstract climate change projections into locally-relevant and meaningful information. Additionally, by visualizing where new growing seasons might emerge, this storytelling can reframe the climate change narrative from inevitable loss to future innovation. Participants commented:

"As a knowledge mobilization person... having tools like this where you can not only predict certain things... but to have a look at geographic differences... it has that potential to be able to have this place-focused storytelling capacity" (FG2, P8)

"It's also good to show that they're not all necessarily bad. We are opening up new opportunities as well... rather than saying the doom and gloom... even in the worst climate scenarios, there are still opportunities there"(FG2, P5).

Participants expressed that the model can serve as a catalyst for identifying research gaps and coordinating collaborative inquiry. Since improving the model requires more granular data, participants suggested treating its development as a collective effort. One participant stated:

"You could mobilize the entire province to start collecting this type of data so that your model can get better...we help develop the data that helps you develop the model" (FG2, P6).

4.3 Policy Risks and Land Use Protection

A major concern expressed by participants was the potential misuse of the model by policymakers and land developers. Participants caution that data and model outputs characterizing an area as having low future agricultural suitability could be used to justify removing land from the ALR. They warned that the model's projections could reinforce a one-way dynamic in which farmland is converted to urban development rather than protected or rehabilitated. One participant explained:

"Oftentimes, the excuse is that the soil is degraded to such a point that we can't do anything on it... So it's just a concern that, you know, well, 'I've done the modelling, and in five years, it looks like you know, the agricultural capability is tanking. So let's just take it out and convert it now...It would be nice if we're using it to increase the ability to farm, not to use it as an excuse not to farm" (FG2, P1).

5. Recommendations

The following recommendations are based on participant feedback concerning strategic priorities, usability barriers, and model limitations. The recommendations are derived from feedback on the specific data platform (i.e., Agrilyze) and model explored in this study; however, the recommendations have broader applicability and implications for the development and use of agricultural sustainability models and spatial data platforms in general.

User experience: Resolve technical, accessibility, and cognitive barriers

- Address platform compatibility issues (e.g., Safari access for Mac users).

- Improve visual inclusivity by implementing pattern-based visualizations as an alternative to colour gradients to ensure the platform is accessible to colourblind users.

- Simplify the interface to reduce visual noise for non-academic users, and also consider pre-loading climate scenarios (i.e., worst-case scenarios that clearly present future climate risks).

- Provide user help and guidance by integrating help icons and a user-friendly navigation guide.

Feature enhancement: Revise comparison slider and customization capabilities

- Improve slider usability by providing clear labelling on the comparison slider to prevent confusion about which side represents a particular data layer or scenario.

- Enable custom parameters by developing user-input fields, which allow users to adjust suitability parameters for specific crops and species.

Data addition: Integrate localized biophysical and economic variables

- Add data on water access and licensing, as suitability is heavily dependent on irrigation.

- Incorporate soil characteristics into the model to capture local biophysical constraints, including soil salinity, nutrient availability, and pH.

- Add economic indicators and operational variables to the model, such as production costs, expected yields, and supply-chain infrastructure.

Model expansion: Increase scope, risk assessment, and interventions

- Expand models to include extreme climate events (e.g., heat domes, wildfires) and localized environmental processes, such as sea-level rise and saltwater intrusion.

- Incorporate sub-seasonal metrics in ways that move the model beyond primarily presenting annual averages and toward capturing sub-annual, seasonal dynamics, such as emerging opportunities for growing crops in shoulder seasons and changes in frost-free days.

- Account for on-farm adaptations by including the mitigating effects of protective farm infrastructure on crop suitability, such as hoop houses and shade cloths.

- Broaden the model's agricultural scope to include not only annual vegetables but also perennial crops, tree fruits, and livestock systems.

Climate strategies: Develop guided interpretation tools and collaborative networks

- Include features in the data platform that enable the generation of regional summary reports, providing synthesized, near-term (5-to-10-year) regional summaries of trends, emerging risks, and potential adaptations to reduce interpretation burden and bridge scientific modelling with policy implementation.

- Visually communicate uncertainty and increase data transparency by displaying confidence levels of model outputs directly on the maps of these outputs (e.g., using hash marks over areas of low/lower model accuracy).

- Implement disclaimers that clearly articulate the intended use of the model and data, specifically that these are tools for identifying agricultural improvement and enhancement opportunities and are not to be used as justification for transitioning land out of the ALR.

- Foster collaborative data collection and modelling processes by engaging producers, planners, and researchers in province-wide efforts to collect and integrate more data into the model in ways that continuously refine and improve the model ability to serve as an effective tool for agricultural planning and policymaking.