IN FACTIS PAX
IN KNOWLEDGE {THERE IS} PEACE
journal of peace education and social justice

Volume 19 Number 1 (2025): 213-243
https://openjournals.utoledo.edu/index.php/infactispax
ISSN 2578-6857

Using Climate Simulators to Facilitate Peacebuilding: A Study of Practice

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Abstract

As the climate crisis approaches a critical juncture, the pursuit of ecological peace becomes increasingly vital to conflict resolution and peacebuilding efforts. This article explores the pivotal role of climate simulators in fostering peacebuilding through informed, data-driven dialogues. These tools anchor peacebuilding initiatives in scientific reality, enabling the identification and assessment of the co-benefits and co-considerations associated with climate-related actions. Furthermore, they promote scenario-based planning within peacebuilding contexts. Drawing from the author's personal experiences with the En-ROADS Climate Simulator in both secondary education and peacebuilding education settings, this article demonstrates the practical application of these tools. The En-ROADS Climate Simulator serves as a powerful example of how climate simulators can be integrated into educational frameworks to enhance understanding and engagement.

The article provides actionable recommendations for incorporating climate simulators into broader educational environments, community advocacy efforts, and legislative processes. By emphasizing the significance of data visualizations tailored to specific geographic locations, the article highlights how personalized climate simulation tools can inform and support sustainable, long-term peacebuilding strategies. Ultimately, this article underscores the transformative potential of climate simulators in bridging the gap between scientific data and peacebuilding practices, advocating for their active adoption to address the multifaceted challenges posed by the climate crisis.

Keywords: climate simulators, data-driven dialogue, ecological peace, environmental policy, peacebuilding, scenario planning, systems thinking

Using Climate Simulators to Facilitate Peacebuilding: A Study of Practice

The Anthropocene, Modernity, the Information Age, call it what you may, the current era is a time marked by significant human impact on the earth and environment, and includes substantial threats to peacebuilding; namely, nuclear war and climate change that is nearing irreversible levels. While the negative risks of nuclear war have been clearly illustrated to all of humanity via the U.S.'s combat bombings of Hiroshima and Nagasaki in World War II, the negative effects of climate change are not as immediate as the aftereffects of a nuclear bomb. This delay between the decision being made and the effect can lead to a misunderstanding of how climate inaction will impact all global inhabitants. Climate change is expected to motivate large-scale human conflict as weather-related natural disasters like Hurricane Helene in 2024 and the California fires of 2025 become more frequent, more destructive, and more expensive (Smith, 2025), and historical existence of essential natural resources, like fresh water, arable land, and the jet stream, shift or disappear altogether.

In working toward ecological peace, a condition of dynamic equilibrium between human societies and the biosphere in which the sustained health of both is ensured, there are clear areas of influence where local decision makers hold much power and control. Individual neighborhoods, districts, and counties have the power to impact issues of the commons at a direct level. Zoning laws and regulations have a clear and direct impact on the daily life of many and shape the day-to-day routines and norms of the citizenry. Local legislators also make decisions about water use, sustainable energy infrastructure development, and placement of manufacturing facilities. Within this landscape of decisions, ensuring

local leaders have a clear understanding of the climate impacts of their decisions is a crucial piece to working toward a future where we collectively avoid the most detrimental climate impacts associated with global warming.

In the best of times, peacebuilding is difficult. As climate change is a known threat multiplier, peacebuilding within this context of ecological uncertainty depends on an increasing understanding of the impacts of climate change, the levers influencing the rate of climate change, and the interconnected nature, the enmeshment, of this global challenge. Peacebuilding in the next decade within the context of decreasing resource access and increasing natural disasters will bring additional complexity to the process of peacebuilding as climate displacement disproportionately impacts vulnerable populations (Moe-Lobeda, 2016).

The Gray Fire of 2023, which ravaged the area near Medical Lake, Washington, serves as a poignant personal reminder of the toll that climate change can exact on individuals and communities. As someone who lived in the Medical Lake area from 1986 to 2002, I experienced firsthand the devastating effects of this wildfire. The fire not only destroyed my childhood home but also upended the lives of many of my friends and neighbors. Several of my childhood and life-long friends lost their homes, their livelihoods, and faced profound disruptions to their lives in a climate disaster that, at $60 million U.S. dollars of damage, barely made the national news. My personal connection to the Gray Fire underscores the urgency I feel in addressing climate change in order to build peace.

Climate change is a significant motivator of conflict and will only become more so as we move forward due to the anticipated negative impacts of the climate crisis. Peacebuilding within the context of the climate crisis requires peacebuilders who are able to engage others in the climate change conversation to address the underlying causes of climate change while advocating for the good of every global citizen. Climate related disasters are happening more frequently and are more destructive than ever. In 2024, the United States faced 27 individual climate and weather-related disasters resulting in over 1 billion U.S. dollars of damage each, and totaling approximately 182.7 billion U.S. dollars of damage (Smith, 2025, January 10). In the 1980s, by contrast, the U.S. faced an average of only 3.3 climate or weather-related events that resulted in over 1 billion U.S. dollars of damage (adjusted for inflation) (NOAA, 2025). Understanding that it is no longer “if” a community will face a devastating climate event, but “when” it will happen, working to mitigate the worst climate impacts can be supported with tools like climate simulators. As individual communities respond and adapt to this new climate reality with an understanding of how the local response fits into the larger, global, response to climate change, we have the opportunity to work collectively and change our future for the better.

En-ROADS Climate Simulator

One-way peacebuilders can be better equipped to engage in conversations regarding climate change to seek ecological peace is to have access to accurate climate information that is easy to understand and freely accessible to members of communities. One such tool that is well positioned to assist in this necessity is climate simulators (Goodspeed, 2019; Petersen, 2000). While most large data model simulators are proprietary and behind paywalls, one that is feely available and well-designed for mass public interaction is the En-ROADS Climate Simulator, a tool created by Climate Interactive and MIT Sloan.

The En-ROADS Climate Simulator (En-ROADS) is described by Climate Interactive and MIT Sloan in this way:

> *En-ROADS is a global climate simulator that allows users to explore the impact that dozens of policies—such as electrifying transport, pricing carbon, and improving agricultural practices—have on hundreds of factors like energy prices, temperature, air quality, and sea level rise.* (*What is En-ROADS?* (n.d.)).

Key features of this tool which make it highly useful in peacebuilding contexts include a simple interface with clear and easy to read graphs (Figure 1), and educational information regarding the structure of the model in-built to the user interface (Figure 2).

Figure 1

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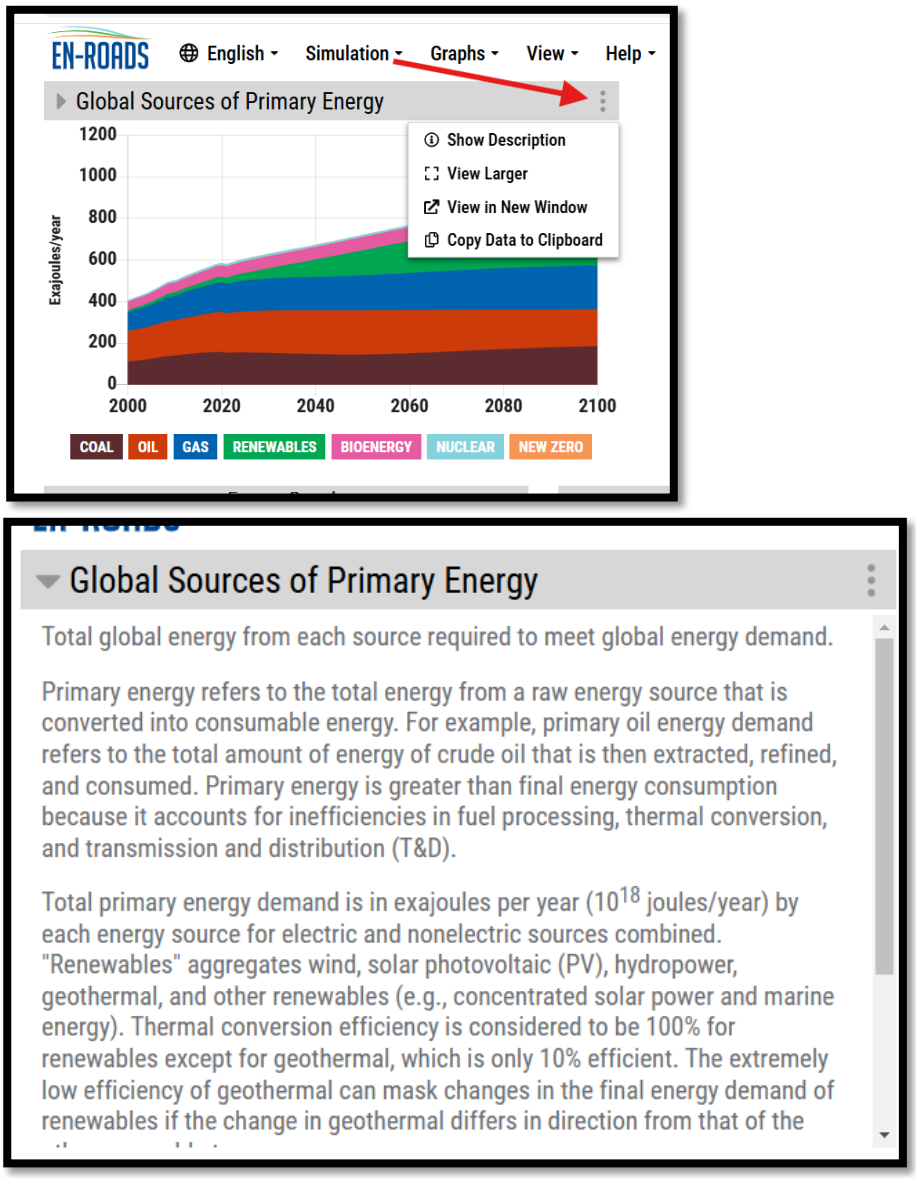
En-ROADS main interface

Note. En-ROADS main page image was captured January 29, 2025 (*En-ROADS simulator,* 2025, January).

Figure 2

Example of En-ROADS expanded navigation controls for individual graphs.



Note. Accessing the three dots feature on the individual EN-ROADS graphs provides related educational information for the user including key definitions and calculation assumptions (*En-ROADS simulator,* 2025, January).

The En-ROADS tool, free to use for anyone with an internet connection, currently offers navigation in 20 different languages. With a commitment to transparency, Climate Interactive provides users with access to modeling data, simulation formula and programming code, and detailed descriptions on baseline assumptions which power simulation output (Figure 3).

Figure 3

Example of En-ROADS expanded educational information for individual sliders.

Note. From the En-ROADS main page, the three dots open an additional interface that allows the user to adjust the assumptions within the simulation. The user is

also able to access specific educational materials for the individual sliders (*En-ROADS simulator,* 2025, January).

Within an individually created scenario, users can modify the baseline assumptions with relation to a policy's implementation start date and other specific rates of increase or decrease by simply moving the sliders. This ability to customize data modeling can help users engage with data and research supported science to understand long-term impacts of climate related decisions.

While climate simulators are helpful in understanding the complexities of climate change and can aid in communicating the urgent need to take action to mitigate the worst impacts of global warming, it is important to note that all climate models involve uncertainty (Mearns, 2010). Simulations are of any sort are simplifications of complex systems and it is important to understand the limitations of the climate model and the implications those limitations have on decision making (Briley et al., 2021). One key point to remember is that climate models are continually growing more detailed and accurate as scientific understanding increases and computer technology advances (Fyfe et al., 2021; Hourdin et al., 2017), so ensuring the tool you are using is up-to-date is foundational to its usefulness in the peacebuilding process. Peacebuilders can also work to understand the individual model assumptions and how those assumptions are arrived at. In general, peacebuilders are encouraged to check the provenance of any tool used to support the peacebuilding process including the use of climate simulators.

In the interest of disclosing my personal engagement with this tool, I have been using the En-ROADS Climate Simulator since 2021 with groups of students in my school community (United World College Changshu China). I have continued my use of this tool due to Climate Interactive's commitment to regular updates of new graphs, free training on new feature use, and step-by-step support of how to best engage with these new aspects of the tool. Through the use of this tool, I have seen meaningful impact in my students in terms of their understanding of the complexity of climate change mediation and equity considerations of climate policy implementation as it relates to peacebuilding. I have used this tool with teachers to model how climate conversations can be used to facilitate peacebuilding skill development across the curriculum. When working with teachers, the in-built education materials are a feature that garner excitement and help educators see how the tool can be used to engage critical, skill-building conversations and data-driven investigations. A key feature educators appreciate is the ability to access program assumptions and underlying formulae and data sets. This transparency of information has been both supportive to learning outcomes and generative of new learning.

The Role of Climate Simulators in Facilitating Peacebuilding

Simulation use in peacebuilding and warcraft is not new (Cuhadar & Kampf, 2014; Finn & Miller, 2022; Glick, & Charters, 1983; Rajkovich, Schwarz, Harris, & Zullo, 2022; Stapleton, 2020); however, historically most simulations are focused on roleplaying within a specific conflict or building a specific skill. In terms of learning, simulators have known benefits for training and knowledge building (Loukissas, 1983; Nance & Sargent, 2002; Rushby, 2016). Across industries, simulators are used to build specific skills and develop proficiency in application before individuals "go live" within the field. Doctors use simulators to practice surgery; pilots log thousands of hours in flight simulators before going up in the cockpit; the automotive industry relies on simulations to train technicians on diagnosing and repairing complex automotive systems without risk to physical equipment; science educators run virtual experiments to help students explore concepts and solve complex problems without the traditional limitations of the physical laboratory; business simulations help professional practice decision making in a risk-free environment, improving strategic thinking and leading to better business outcomes; emergency responders train in disaster response simulations to sharpen skills in life and death situations where every moment counts. In each context, simulators are crucial to the development of critical thinking, problem solving, and applying theoretical knowledge to real world situations. These simulation uses are also opportunities to engage with materials, ask questions, and probe beyond the theoretical to better understand the outcomes created by choices and actions.

In the area of peacebuilding, several game-based skill building tools exist. One such game-based simulation tool is called *PeaceMaker*, a computer-based game that mimics the peace-making process between Isreal and Palestine (Impact Games, 2006). This game-based simulation tool is highly tailored to individual conflicts and the peace challenges within a single context. While engagement with this type of simulation tool can help to build general peacebuilding skill competencies, application of the tool to a novel context is difficult (Cuhadar & Kampf, 2014). Another example in this realm is the live-action roleplaying game Bafa Bafa (Shirts, 1977). Bafa Bafa places participants in one of two fictitious cultures, the Alphas and the Betas, and game facilitators guide participants through the experience and the reflective debrief. This game focuses on cross-cultural communication challenges and brings to light biases which impact intercultural communication (Bredemeier, 1978; Roaten & Schmidt, 2009). This game, as an experiential learning opportunity to build empathy and better understand the causes

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of miscommunication, is well suited for building skills that can be applied to many situations where differences in culture may lead to conflict but is not directly focused on peacebuilding skill development.

Climate simulators are not a game, but an adaptive tool which can be used to develop an overall human strategy for mitigating the worst climate change impacts rather than a specific (i.e.: limited) context. These tools have immediate relevance to a larger set of peacebuilders due to the way the tool is interacted with. Where previous peace-making simulations focused on a specific conflict (i.e.: the Palestinian-Israeli conflict), using climate simulators to focus on the major causes of conflict in the 21st Century (i.e.: increased global warming, climate change, and energy production) changes the framing of peacebuilding conversations. Where previous peace-centered simulations focused on the past, climate simulators focus on the future by encouraging individuals to ask questions about how we can get to the desired future from where we are today, rather than examining how past choices led us to this situation. Understanding this shift from looking at the past to looking to the future, climate simulators are most useful to the peacebuilding process when the simulations are based on models rooted in a sound scientific understanding of climate change and credible, up-to-date research (Conrad, 2009). When a simulator can unite these elements, the result is a powerful tool that can lead to transformation.

Climate simulators and similar technologies that enable the imagining of possible futures have a significant role to play in facilitating peacebuilding, especially in the context of climate change. These tools offer a unique approach to addressing the complex challenges of environmental degradation, resource scarcity, and social conflict by fostering data-driven conversations, improving access to science-based evidence, highlighting co-benefits, and assisting in the evaluation of multiple options in the policy planning phase.

Data-Driven Conversations

Climate simulators provide a platform for stakeholders from diverse backgrounds to engage in constructive dialogues about the potential impacts of climate change and possible responses to these impacts. By visualizing complex scientific data in an accessible format, these tools facilitate a shared understanding of the challenges at hand (Finn & Miller, 2022). This is especially useful in contexts where climate change is not yet a widely understood phenomenon (Climate Disclosure Standards Board, 2020; Rastandeh, 2015). Simulators can translate abstract scientific concepts into tangible scenarios, making the information more meaningful and relatable to laypeople, local authorities, and experts alike. This shared

understanding can foster consensus and reduce conflict by enabling stakeholders to discuss and debate different approaches to climate change mitigation and adaptation.

Simulators can be used to explore the potential social and economic consequences of climate change, not only the physical impacts (Climate Disclosure Standards Board, 2020; Rastandeh, 2015; Wang, Tian, & Xiong, 2019). For example, a simulation could show the potential effects of sea-level rise on coastal communities or the impact of droughts on agricultural production. By visualizing these impacts, simulators can bring attention to the human dimensions of climate change and help stakeholders understand the ways in which climate change can exacerbate existing inequalities or create new forms of injustice (Cuomo, 2011; Gardiner, 2004; Kwauk & Iyengar, 2021; Moe-Lobeda, 2016; Nanthini & Nair, 2021). This awareness can help drive the necessary social and political changes that may be needed to prevent conflicts arising from competition for resources.

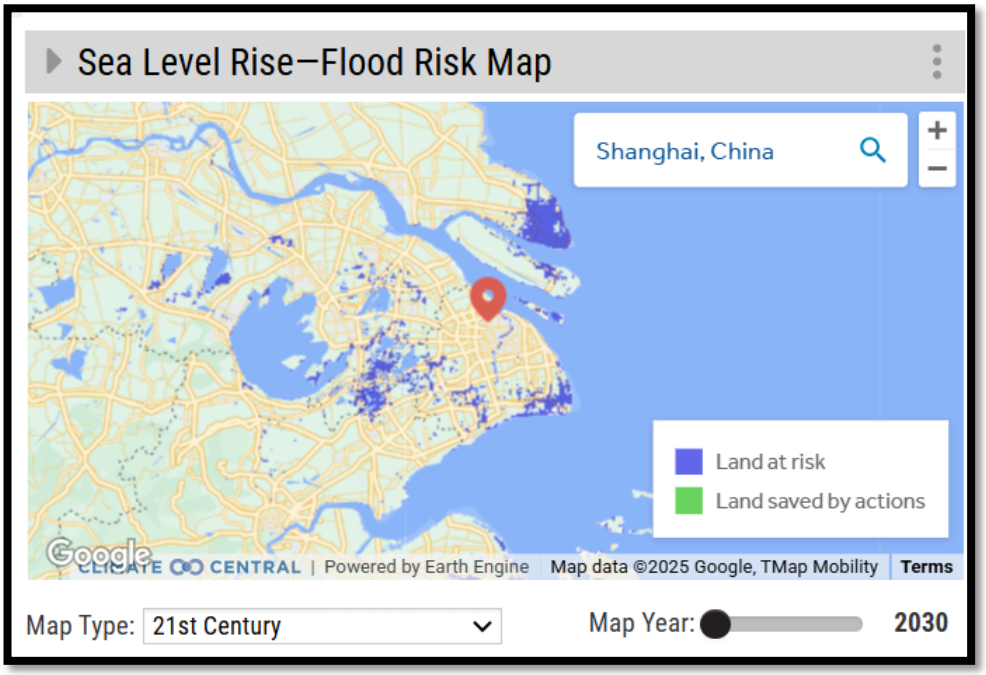
Moreover, simulators can incorporate local knowledge and community perspectives into the modeling process. This inclusion can lead to more relevant and effective solutions that take into account the unique social, cultural, and environmental contexts of a particular region (Broto et al., 2015). By creating a common understanding of the issues, these tools help to bridge the gap between scientific knowledge and local experience, paving the way for a more inclusive and collaborative approach to addressing climate change.

Access to Science-Based Evidence of Climate Change

A key function of climate simulators is to provide access to reliable science-based evidence of climate change. Rather than relying solely on past events, simulators can use projections to create plausible, scientifically accurate scenarios for the future that create a sense of immediacy and relevance for decision makers. The ability of climate simulators to synthesize complex datasets, such as climate models, makes the underlying science more accessible to non-technical audiences (Broto et al., 2015; Mearns, 2010; Petersen, 2000). The presentation of scientific information in an easily digestible format like graphs or maps, as opposed to highly technical reports, can enhance understanding and engagement with climate change data. Further, the ability to visually represent the data can allow stakeholders to grasp the scope and potential implications of different climate scenarios more effectively. This form of access to information can empower local communities and policymakers to make informed decisions, as well as engage in more effective climate change adaptation and mitigation planning.

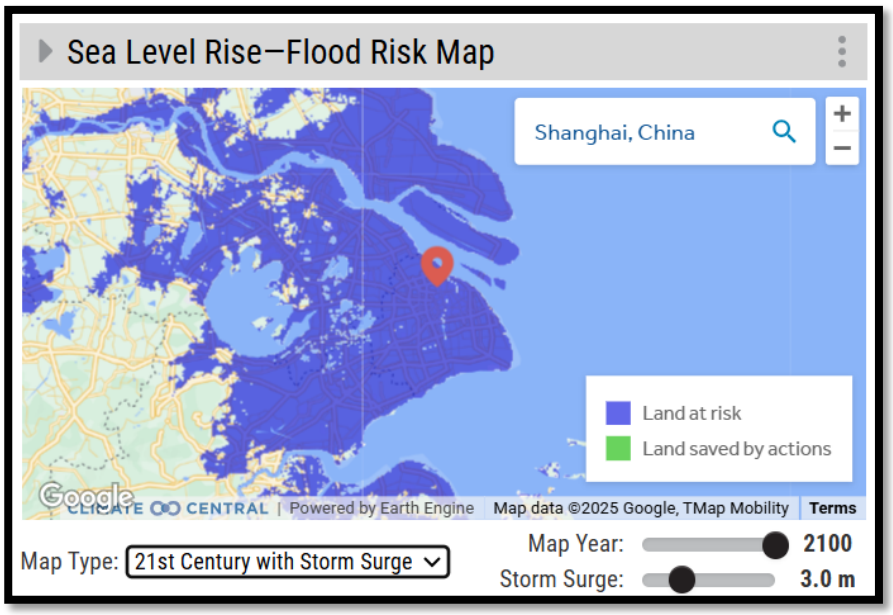
When scientific data is put into visualizations like graphs and maps, the information is accessible to a wider audience. Climate simulations used in the peacebuilding process that capitalize on data visualizations are highly impactful because they aid in telling the human story of climate impact. The "storyline" method of interaction with climate simulators involves modeling extreme weather events under different climate futures to show how an event could unfold (Shepherd, 2019). Using this method to look at the effects of sea level rise coupled with anticipated storm surges for my local area (Shanghai, China), the "now" (Figure 4) and "future" (Figure 5) pictures created by the data are clear: much of the area will be changed affecting the lives and livelihoods of many.

Figure 4 *"NOW" Sea Level Rise – Flood Risk Map (default view)*



Note. Figure shows the 21st Century view of the three map view options provided. Map year is 2030. Screen capture taken February 7, 2025 (*En-ROADS simulator*, 2025, February).

Figure 5 *"Future" Sea Level Rise – Flood Risk Map (storm surge view)*



Note. Figure shows 21st century with Storm Surge view. The map year is 2100. The storm surge is set at 3.0 meters. Screen capture taken February 7, 2025 (*En-ROADS simulator*, 2025, February).

In looking at the landmass at risk for flooding due to sea level rise in 2030 (Figure 4) and comparing the landmass impacted in the possible future of 2100 (Figure 5), the increased impact of flooding due to climate change is immediately clear and provides a powerful place to start from to find solutions that will mitigate the harm to individuals and communities represented in these images. The "storyline" method is an effective approach to communicate the impacts of climate change as they relate to peacebuilding because it frames risk in an event-oriented manner, which aligns with how people perceive and respond to risk. This approach taps into how people process information experientially, through personal experience and emotion, as well as analytically, through rational and deliberate analysis.

In addition, the use of data-driven simulations can reduce reliance on opinion and conjecture in decision-making by offering a more objective way to analyze the potential consequences of different policies or interventions. This can be particularly important in contexts where there may be conflicting viewpoints

about the urgency or severity of climate change. Prior to 2024, thinking about the likelihood of a storm surge in an inland community, like that of Asheville, North Carolina, would have been unheard of. The reality is that many inland communities are at increased risk of flooding due to higher intensity storms bringing more rainwater to these locations. Presenting data-driven evidence of climate change can shift the dialogue from debates about the reality of climate change to discussions about how to address the challenges it poses. The use of simulations can help overcome the communication gap between climate science and decision-makers.

Considerations of Co-benefits

Beyond visualizing the direct impacts of climate change, simulators can also be used to demonstrate the potential co-benefits of mitigation and adaptation strategies. Co-benefits refer to the positive outcomes that arise from climate actions, in addition to reducing greenhouse gas emissions or increasing resilience (Ceballos, 2020). By using simulators to highlight these co-benefits, stakeholders in the peacebuilding process may be more motivated to adopt sustainable practices. For instance, a simulator could show that investing in renewable energy not only reduces greenhouse gas emissions, but also improves air quality, improves public health, and decreases the likeliness of ocean coastline degradation due to erosion from sea-level rise. Similarly, a simulator could demonstrate that urban greening projects can reduce urban heat island effects, enhance native pollinator habitat availability, and increase the aesthetic appeal of a community. Highlighting these co-benefits can broaden the appeal of climate action and create a win-win situation for both the environment and society.

In addition to highlighting co-benefits, simulators can help peacebuilders reveal potential trade-offs that may exist between different climate change mitigation and adaptation strategies, as well as trade-offs between climate action and development objectives. For instance, policies that promote high-density development to reduce emissions may also increase exposure to heatwaves. By identifying such trade-offs, stakeholders can seek out strategies that are most aligned with the priorities of peacebuilding such as reducing inequality or promoting justice. In a practical sense, the simulators can also help planners to understand when to apply which strategy, and how to leverage key resources. Ultimately, the use of simulators to evaluate a wide range of factors can lead to more holistic and sustainable solutions that create multiple benefits for communities. By considering both direct and indirect effects, and by demonstrating potential co-benefits, simulators can foster a more inclusive and collaborative approach to climate action.

The Ability to Evaluate Multiple Options in the Ideation and Planning Phase

Climate simulators allow stakeholders to evaluate and compare a range of options in the ideation and planning phases of peacebuilding. This capability is critical for developing robust and flexible solutions that can adapt to various possible futures (Finn & Miller, 2022; Goodspeed, 2019; Rastandeh, 2015; Rajkovich et al., 2022; Stapleton, 2020). By testing different scenarios, stakeholders can identify policies and actions that are most likely to be effective under conditions of uncertainty. This may help to avoid strategies that are based on the assumptions of a stable climate future. The ability to evaluate multiple options can help planners avoid "lock-in" to maladaptive practices or technologies. For instance, if a simulator shows that a particular infrastructure investment is not resilient to climate change, decision makers can re-evaluate the investment and consider alternative options (Harvey et al., 2013; Mearns, 2010). This form of robust decision-making is particularly important in the context of climate change, where uncertainties are high and the consequences of decisions can be long lasting.

Climate simulators can be used to engage stakeholders in participatory planning processes. By allowing stakeholders to experiment with different options and see the potential outcomes, simulators can empower each stakeholder to become an active participant in the decision-making process (Broto et al., 2015; Goodspeed, 2019; Rajkovich et al., 2022; *What is En-ROADS?*, n.d.). This participation increases buy-in and enhances the likelihood of successful implementation of climate policies. In particular, the use of scenario planning can help to establish consensus around a preferred course of action. Ultimately, the ability to explore a wide range of options in the planning phase can lead to more innovative and creative solutions that are well-suited to the specific challenges faced by a community. By empowering stakeholders to analyze potential consequences of various policies or actions, simulators can promote a more collaborative approach to planning and peacebuilding, where all stakeholders are invested in the development of solutions that are effective and aligned with their values.

Application in Different Contexts

As we navigate the complexities of peacebuilding in the context of climate change, the integration of innovative tools like climate simulators becomes increasingly vital in our efforts to foster ecological peace and resilience. The earlier sections of this paper highlighted the significant threats posed by climate change

and the crucial role of local decision-making in mitigating these impacts. We explored the transformative potential of the En-ROADS Climate Simulator in facilitating data-driven dialogues and informed decision-making. Building on these foundational ideas, this section delves into the practical applications of climate simulators across various contexts, demonstrating their versatility and effectiveness in promoting peacebuilding.

Climate simulators, such as the En-ROADS Climate Simulator, offer a unique approach to addressing the multifaceted challenges of climate change by providing stakeholders with accessible, science-based insights. These tools enable users to visualize the long-term impacts of different climate policies, fostering a deeper understanding of the interconnected nature of climate change and its implications for peacebuilding. By bridging the gap between scientific data and practical action, climate simulators can empower individuals and communities to make informed decisions that promote sustainability and resilience.

Educational Applications Fostering Peacebuilding Skill Development

Climate change simulators are powerful tools for classroom use, enhancing student learning and engagement in several ways. These benefits are broadly categorized into the development of critical thinking, empathy, peacebuilding skills, and action-oriented learning. These important skills are not confined to a single discipline or content area, creating the possibility of interdisciplinary applications and opening additional avenues for teachers who are working to un-silo content area and create more authentic engagement with the world at large.

Critical thinking skills are widely regarded as necessary in today's education. As students engage with climate simulators, each is required to analyze complex, interconnected systems and think critically about the potential consequences of various actions and policies. Simulators move students beyond passive learning by actively involving them in the learning process to explore complex systems, test hypothesis, and make decisions based on their analysis. The application of systems thinking to plan and evaluate a range of possible futures requires students to consider multiple perspectives and engage with uncertainty (Magro, 2015). A simulator like En-ROADS allows users to test different climate policies and observe the resulting impacts or co-benefits, promoting a hands-on understanding of climate change dynamics. Using technology and engaging with data and models in the simulation, students are pushed beyond a simplified understanding of climate change to better grasp the underlying scientific principles and make informed judgements.

Simulations encourage students to consider issues from different perspectives, building empathy. By stepping into different roles, whether as policymakers or stakeholders, students can gain a deeper understanding of diverse viewpoints and the challenges others face (Truong-White & McClean, 2015). When students connect with the material on an emotional level, they are often more willing to consider different viewpoints. This is one of the on-ramps I use with this tool in my English classroom with the various texts we read each year. In accessing the power of narratives within scenario planning to ask questions about what conflicts may be raised if a change were to be implemented, there are pathways that link students' lived experience with that of the texts we study, and from that there are further links to their global peers' experience. Using simulators as a starting place to ask questions about issues can help students look beyond their limited lived experiences and consider the multitude of experiences facing people around the world. The use of simulators as a starting point can also challenge our individual preconceptions and can help us build bridges with those who hold different views than our own.

Using simulators can help develop peacebuilding and negotiation skills though engagement with global issues with no clear "right" solution. Simulations that involve negotiation or mediation, perhaps by assigning a variety of roles or values to students, allow students to practice these skills in a safe and controlled environment. They learn how to strategize, communicate effectively, and consider the needs and interests of multiple parties across a range of areas, which are crucial for conflict resolution. The use of climate simulators can also help train a student's third party mediation skills by allowing students to experience conflict from multiple points of view and consider various strategies for conflict resolution. En-ROADS helps with this by raising equity concerns for every slider within the interface that can then enrich engagement through exploration of the impacts raised in these areas.

Using simulators can empower students to act as peacemakers through meaningful climate change engagement. By seeing the direct consequences of their decisions within the simulation, they are more likely to see their agency and the possibilities of influencing the future (Green et al., 2020). This speaks to the true heart of education: working to make the world a better place. The process of critical thinking development, fostering empathy, and improving peacebuilding and negotiation skills can combine to inspire students to see themselves as agents capable of creating alternative futures (Truong & McLean, 2015). These "ah HA" moments which have come after En-ROADS sessions in my classroom have inspired concrete action plans from students and increased advocacy.

Community Advocacy and Peacebuilding

Community advocates and grassroots movements can leverage climate simulators to achieve their initiative goals and further their advocacy for peacebuilding in several ways. While student use of climate simulators is focused on skill building through scenario exploration, community advocates will find targeted scenario use helpful in conjunction with local policy, statutes, or law, to address specific challenges the community faces. Simulators can help community advocates and grassroots movements engage with complex issues, build consensus, and develop effective strategies by providing a platform for data driven analysis and scenario planning.

Climate simulators can be used as a tool to educate both community members and public officials about climate risks and opportunities. While using climate simulators in a classroom setting has noted positive outcomes, using climate simulators in the context of community advocacy changes the dynamic of the individuals using the tool thereby changing how the tool can be used effectively. In community advocacy settings, the power of the climate simulator is how data is visualized and impacts are clarified through the exploration of multiple climate scenarios which can make complex scientific information more accessible and understandable. This can be particularly effective when using a storyline approach, as previously mentioned, where past extreme weather events are modeled under different climate futures, making the information more relatable and immediate. This approach helps in framing risks in an event-oriented manner, which aligns with how people perceive and respond to risk.

Climate simulators can assist in identifying the forces contributing to climate change, such as land-use polies, transportation investments, and energy consumption. By exploring these factors, community advocates can develop targeted strategies to address specific issues. Community advocates in urban areas could use a simulator to analyze the effects of different land-use patterns on local temperatures and develop plans to mitigate urban heat island effects. An environmental advocacy group, Citizens Climate Lobby, has used the En-ROADS climate simulator to encourage the adoption of carbon pricing as a high leverage tool against climate change (Winchester, 2022). By manipulating different variables within the climate simulator, community groups can evaluate the potential outcomes of various actions and make informed decisions while setting strategic direction and planning action.

Simulators can be a valuable tool for building consensus among diverse stakeholders while promoting agency. By providing a common platform for exploring different scenarios and their impacts, climate simulators can foster

dialogue and collaboration. By actively manipulating variables and observing outcomes, community members can develop a sense of agency and understand how their actions can make a difference, which can be particularly empowering for marginalized groups who may feel disempowered by larger structural issues. This collaborative approach to building community consensus can align different perspectives and create a sense of shared responsibility for addressing climate change. Simulators can be used to engage more of the community in the planning process while encouraging discussions about how to achieve a more equitable, just, inclusive, and resilient future for a community. This participatory approach in decision making is essential for fostering a sense of ownership and ensuring that the community's needs and priorities are reflected in the final decisions.

Climate simulators provide community advocates and grassroots organizers with powerful tools for education, strategic planning, decision-making, and community engagement. As climate change is a known threat multiplier that can lead to conflict, these simulators play a crucial role in promoting equitable resource management and sustainable development, addressing the root causes of potential conflicts. By highlighting how climate change disproportionately affects vulnerable populations, climate simulators help to address issues of social justice, ecological peace, and equity. Additionally, they facilitate the building of partnerships within and across communities, promoting the idea of a "sweet spot" for climate action at the scale of communities, metacommunities, or cities. This approach supports both local and global impact, fostering a collaborative effort to mitigate climate change and enhance resilience.

Climate Simulators for Policy and Peace

Climate simulators can be powerful tools in policy-making and legislative processes to foster a more peaceful and sustainable world by informing decisions, promoting collaboration, and enabling long-term planning. They allow policymakers to explore complex issues, assess the impacts of different policies, and engage stakeholders in meaningful dialogue. By incorporating these tools into policy and legislative processes, governments and communities can work towards creating a more hopeful and peaceful future through responsible policy development and implementation.

Similar to the use of climate simulators in community advocacy and grassroots movements, climate simulator use within the legislative space can inform policy decisions. Simulators, like En-ROADS, allow policy makers to assess how changes in energy supply, demand, and other variables may impact emissions and climate outcomes. Some compelling examples of climate simulator

use involve instances of En-ROADS's use with U.S. Congress and the UN Secretary-General's Office. Currently, the Environmental and Energy Study Institute (EESI) uses En-ROADS as part of the many Congressional briefings it holds each year focused on supporting climate change mitigation policy in the U.S. (O'Brien, 2025). By manipulating variables in En-ROADS such as global GDP, energy efficiency, carbon pricing, and fuel source mix, policy makers can quickly assess the impacts of various policy scenarios on cumulative emissions. This enables policy makers to make more informed decisions about which policies will be most effective in achieving climate goals.

As policy makers engage with scenario analysis via climate simulators, columns of numbers from spreadsheets transform into a human narrative via the visualization of climate change impacts on local communities. This transformation of data into storytelling humanizes and personalizes the policy decisions by helping policy makers see the individual lives that will change, for the better or for the worse, as a result of their actions. This helps to address one of the major hurtles many policy makers face: lack of expertise in the areas that their policy decisions impact. Providing assistance in storytelling is where climate simulators can impact decision makers.

Let's consider a hypothetical example related to energy efficiency policy in the industrial sector when compared to a baseline (Figure 6):

Figure 6

En-ROADS Simulation with Building and Industry Energy Efficiency set at Baseline

Note. En-ROADS baseline scenario showing Temperature Change graph and detailed view of the Buildings and Industry Efficiency slider. The baseline assumption sets status quo for this slider at 1.2%/year increased energy efficiency. The baseline scenario results in 927.16 exajoules/year total primary energy demand in 2100. Screen capture taken February 7, 2025 (*En-ROADS simulator*, 2025, February).

A policy maker considering the impact of setting energy efficiency policy for new industrial buildings and manufacturing at an improvement rate of 2.4%/year (Figure 7) or 3.1%/year (Figure 8), may not grasp what the impact of a 0.7%/year improvement will have on climate change outcomes over the time scale of 70 years.

Figure 7 *En-ROADS Simulation with Building and Industry Energy Efficiency set at 2.4%/year*

Note. En-Roads scenario with policy change starting in 2025. This scenario results in 736.91 exajoules/year total primary energy demand in 2100. Screen capture taken February 7, 2025 (*En-ROADS simulator*, 2025, February).

Figure 8

En-ROADS Simulation with Building and Industry Energy Efficiency set at 3.1%/year

Note. En-ROADS scenario with policy change starting in 2025. This scenario results in 669.54 exajoules/year total primary energy demand in 2100. Screen capture taken February 7, 2025 (*En-ROADS simulator*, 2025, February).

Placing the different rates for increased industrial building energy efficiency into a climate simulator can aid the policy maker's understanding of how the policy rate difference impact total energy use over time. What may look like a small difference to a policy maker, the +0.7%/year increase in industrial building energy efficiency proposed in this hypothetical, can be significant in terms of overall impact on the environment.

Isolating this one policy change in En-ROADS, there are clear ecological benefits when comparing status quo (Figure 6), to an increase of 2.4%/year (Figure 7), or an increase of 3.1%/year (Figure 8) related to new buildings and industry energy efficiency. A policy maker using the En-ROADS Climate Simulator can see

the overall decrease in energy demand, starting at 927.16 exajoules/year (1 exajoule = 174 million barrels of oil), and decreasing to 736.91 exajoules/year, and then decreasing further to 669.54 exajoules/year. In terms of what this policy difference means for citizens and community members, this puts global total energy consumption in 2100 on par with the current consumption in 2025. Additionally, a policy maker can see that the total temperature increase is also impacted positively in 2100, starting at 3.3°C/6.0°F, and then going down to 3.5°C/5.7°F and then down to 3.1°C/5.5°F. While this last scenario's predicted total temperature increase (Figure 8) is still very high and well above the 3.6°F (2°C) threshold that scientists believe we must stay under to prevent the worst climate change impacts, there is a clear positive which moves us collectively closer to mitigating the worst impacts from climate change.

Using this hypothetical example, climate simulators like En-ROADS can play a critical role in bridging the gap between complex data and actionable policy decisions. By transforming numerical data into compelling visuals that help to generate narratives, these tools can help policy makers visualize real world impacts of their decisions on local communities. Not only does this enhance the policy makers' understanding of the potential outcomes of climate actions, it also humanizes the policy-making process. One of the outcomes in this hypothetical is the added clarity of how seemingly small changes in energy efficiency policies can lead to significant ecological benefits over time. By leveraging climate simulators in this way, policy makers can make more informed decisions that contribute to a sustainable future, ultimately moving us closer to a more peaceful future by mitigating the worst impacts of climate change.

Conclusion

Climate simulators are uniquely helpful in facilitating peacebuilding conversations as they center climate impacts we will face and invite shared problem solving. As the impacts of climate change are made visible through the data visualizations and interactive maps created by climate simulators, conversations are future focused, rather than past focused. This shift can be powerful because when we are looking forward, there is a heightened feeling of urgency about working to mitigate or avoid future climate disasters. There can be a greater sense of impact through action as decision makers can see the cumulative impact of policy decisions over several decades, highlighting the intergenerational relevancy of our choices today on our children and grandchildren tomorrow.

Climate simulators are also helpful to peacebuilders in facilitating deeper consideration of the lived impacts of climate change. Climate simulators and the

data visualizations they are capable of providing are well situated to assist with the communication of storyline scenario exploration. Engaging stakeholders with an imagining of possible futures related to climate challenges can encourage the consideration of potential co-benefits and highlight dynamic systems relationships that may create unintended consequences.

As climate disasters become more frequent and severe, they will soon touch the lives of every person on the planet in a direct and personal way. This reality highlights the critical importance of using tools like climate simulators to prepare for and mitigate the impacts of such disasters. Experiencing climate disasters firsthand can deepen one's understanding of the urgent need for peacebuilding efforts that address the root causes of climate change and promote resilience. By incorporating personal narratives into the broader discussion of climate change, we can foster a deeper understanding of the human dimensions of this global challenge and inspire more effective and compassionate responses. The time for action is now, as the window to prevent the most catastrophic outcomes is rapidly closing.

Resources for Further Exploration

- En-ROADS Climate Simulator – https://www.climateinteractive.org/en-roads/ and the C-ROADS Climate Change Policy Simulator - https://www.climateinteractive.org/c-roads/
  These tools allow users to explore the impact of various policies on factors like temperature and sea level rise, fostering data-driven dialogues and informed decision-making for sustainable peacebuilding strategies.
- Probable Futures - https://probablefutures.org/
  This resource can help peacebuilders visualize and communicate possible impacts of climate change by offering accessible, science-based insights into different climate futures, thereby supporting more informed and collaborative approaches to climate action.
- Climate Central - https://www.climatecentral.org/
  This resource provides data and visualizations that can be used to educate community members and public officials about climate risks and opportunities, facilitating strategic planning and community engagement in peacebuilding efforts.
- NASA Sea Level Change - https://sealevel.nasa.gov/
  This resource offers data and information about sea-level rise, enabling stakeholders to create plausible, scientifically accurate scenarios and understand the potential social and economic consequences of climate change on coastal communities.

- Climate Adaption Knowledge Exchange (CAKE) - https://www.cakex.org/ CAKE provides a platform for sharing knowledge and best practices in climate adaptation, helping peacebuilders identify and implement effective strategies to build resilience and address the root causes of potential conflicts.

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