

# Climate Solutions Guide for Game Jams

*Presented by the International Game Developers Association*

*Climate Special Interest Group (IGDA Climate SIG) - v1.0*

**Welcome!** This “solutions guide” is a resource for game jams to bring you up to speed on key topics and solutions related to climate change. By including climate solutions in games, we are helping players imagine the path forward toward a positive climate future. Imagination can, in turn, [enable climate action](#) on the ground. Each of the following chapters is a bite-sized look at a specific topic, originally written for themed game jams within the IGDA community.

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# 1. Why Focus on Solutions?

In the early days of environmental education, psychologists believed in a **linear model of behavior change**, arguing that all one needed to do to inspire change was to provide information about the environment and threats to its health and resilience. They quickly learned that **building awareness is not enough to make a lasting difference**.

Focusing solely on raising awareness about climate-intensified disasters can lead to a wide variety of psychological responses, including:

- **Disengagement.** Problems might feel overwhelming and outside the scope of what an individual is able to change.
- **Distrust.** Over time, it might feel like nothing is being accomplished by governments, companies, and NGOs, eroding trust in institutions or even human nature as a whole.
- **Doomism.** A post-apocalyptic future might feel inevitable, especially for players who already spend much of their time in post-apocalyptic game settings.
- **Normalization.** Repeated exposure to climate impacts can shift perceptions around what is normal and expected from disasters - even for those on the front lines! Since the climate is changing over the course of decades and not days, this can obscure a steady growth in disaster intensity.

Consumers are already inundated with messaging focused on the problems of climate change. By focusing solely on problems, we are not adding anything to the public discourse. We can build a more comprehensive understanding of climate change by focusing on solutions, cultivating:

- **Engagement.** Solutions create opportunities for individuals to be proponents of change, helping them feel empowered to make a difference.
- **Trust.** Showing policies and interventions enacted by governments, companies, and local communities that have been undeniably successful at mitigating climate impacts can restore trust and build support for wider adoption.



- **Hope.** Hope is not just a feeling, but a cognitive construct based on our ability to visualize a path from the present to a positive future. Solutions help illustrate the path forward.
- **Connection.** Modern environmental psychology emphasizes the importance of social norms in defining our attitudes and behavior. We are heavily influenced by those around us, and solutions create opportunities to bring people together around shared values.

Solution-focused messaging helps us move beyond awareness-building into the core predictors of pro-environmental behavior: **attitude, perceived self-efficacy, and hope**. To learn more about how environmental psychology connects with game design, check out the [Environmental Game Design Playbook!](#)

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## 2. Why Community-Level Solutions?

For many, the first thing that comes to mind for “climate action” are lifestyle changes: reducing waste, biking rather than driving, eating less meat, or using less energy at home. While these individual actions are helpful, **we risk deflecting responsibility** onto well-meaning individuals for the climate crisis if we only focus on individual actions, leading to many negative outcomes:

- **Guilt.** An individual may feel guilty for their individual contributions to climate change, leading them to disengage or only focus on actions that reduce their personal carbon footprint - if they have the means to.
- **Hostility.** Individual action becomes a measure of personal virtue, leading some adopters to be dismissive or hostile toward non-adopters. This can create division even between fellow climate activists.

- **Tunnel vision.** When we focus only on ourselves, we might miss more impactful ways we can make a difference, such as exerting influence within our workplace, trusted circles, or local community.

We do not live inside a vacuum. Each of us lives within political, economic, and social systems that provide both services (some life-saving) and constraints on how we can live. **These systems are not immutable.** Communities across the world are implementing new policies to mitigate and adapt to the impacts of climate change [with the backing of 89% of the global population](#). We have an opportunity as game designers to illustrate how systems can change, supporting:

- **Collective action.** By understanding how systems change, individuals can seek out groups where their voice carries sway and authority, such as speaking up as a citizen in local city council meetings, as a subject matter expert in industry action groups, as an investor in asset management firms, etc.
- **Bridge-building.** Focusing on systems demonstrates the importance of building bridges and accepting that different people have different value systems and different understandings of what is most effective. We don't have to see eye to eye on everything in order to come together and advocate for healthy, resilient communities.
- **Connection.** By centering our games in community response, we emphasize that individuals don't have to take on the climate crisis by themselves. Climate change is a global issue that will require a global response. We can be part of the response by engaging deeply within our communities.

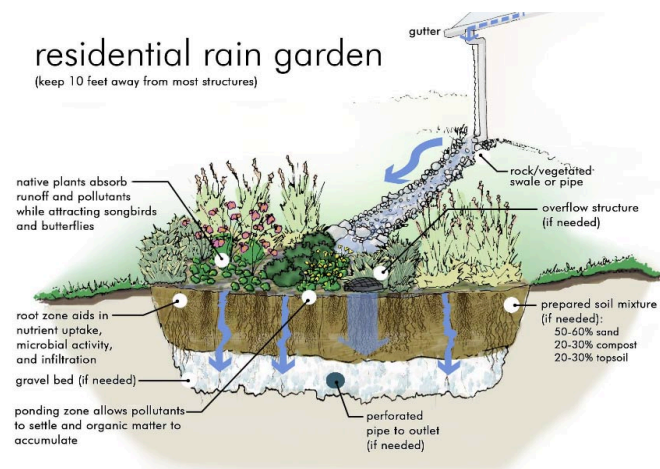
While individual action will continue to have its place in climate conversations, including community action in your messaging may be one of the most impactful things you can do to positively influence the public conversation around climate change.

### 3. Flood Resilience

Flooding is expected to become more frequent and intense due to global climate change. However, there are key solutions for mitigating risk. By showcasing these solutions in game content, we normalize them in public discourse. Below are solutions both old and new with various benefits (+) and drawbacks or limitations (—), to serve as a starting point for creative content.

**Dams** - + A classic structural solution to seasonal riverine flooding, dams allow fine control over the volume of water directed downstream for irrigation. Additionally, dams allow communities to harness hydropower and help build resilience to drought through water storage. — However, several drawbacks to dams have also been identified across the last several decades. Dams can pose significant obstacles to fish migration, even with fish passage structures. Many species rely on the seasonal flow of the river as external signals for migration, growth, and reproduction. Dams may alter habitat and decrease water quality by impacting river temperatures and distributing sediment. Additionally, while dams have been successful at controlling the frequency and intensity of riverine flooding, studies indicate that they have not been effective at reducing infrastructural damage from flooding as they have also opened floodplains for further residential construction. In other words, the benefits of dams for flood resilience have largely been offset by changes in land use and behavior.

**Rain Gardens** - + A rain garden is a green infrastructure solution for building flood resilience in communities. Rain gardens are individual or community-level gardens built in depressed areas where rainwater is most likely to flow, reducing runoff. Rain gardens can utilize native plants to double as biodiversity hotspots. — Rain gardens should not allow for standing water, which can pose a risk for vector-borne illness.

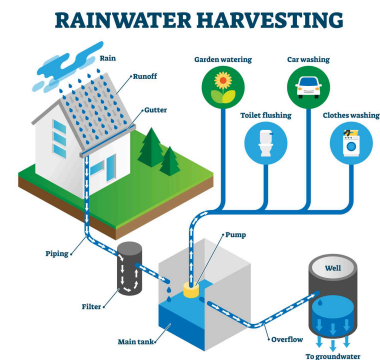




**Bioswales** - + Similar to rain gardens, bioswales can be used to capture rainwater and filter out potential water pollutants from a first rain event in urban areas. Bioswales can be integrated into medians, roundabouts, and other public infrastructure. Bioswales can include drainage networks underneath for effective water capture and drainage. — As with rain gardens, bioswales should not allow for standing water.

**Permeable Pavements** - + Permeable pavements build flood resilience by allowing rainwater to infiltrate soils below pavement, rather than needing to be collected as runoff. Permeable pavements offer an alternative to conventional drainage features and additionally help build heat resilience in urban areas by reducing pavement surface temperatures and reflecting more heat than traditional pavement.

**Rainwater Harvesting** - + In addition to being redirected to rain gardens or drainage networks, rainwater can be harvested and stored for long-term use in rain barrels above or below ground. Rainwater can be used as greywater for gardening and landscaping. — Rainwater may collect pollutants from surfaces while being harvested, so it's not recommended for most other household purposes.



**Levees and Floodwalls** - + Levees and floodwalls are structures that hold back floodwaters from sensitive infrastructure, with levees being built from compacted, impervious soil and floodwalls from concrete. Levees and floodwalls are a popular choice for flood mitigation as they do not require structures to be relocated or otherwise retrofitted.

— However, if the level of flooding the levee/floodwall has been designed for is exceeded, the resulting damage can be far greater and more intense than having no protection at all. Levees in particular require considerable land area due to the need for gentle embankments to prevent erosion.

**Seawalls and Jetties** - + Similar to floodwalls, seawalls can offer a buffer for keeping structures safe from coastal storm surges. Seawalls are generally high structures built to dissipate wave energy, and are often sloped for this purpose. Jetties are smaller constructions intended to protect a coastline from erosion and to reduce the flow of sediment into or out of an inlet. — Seawalls and jetties are both effective and time-tested mitigation measures, but if poorly implemented, they can impact intertidal habitats and can displace, rather than prevent, coastline erosion (increasing erosion in a different location rather than preventing it altogether). Seawalls can be heightened and modified over time to combat rising sea levels; however, if they have not been designed with this in mind, retrofitting seawalls can be costly. Additionally, similar to dams, seawalls may incentivize increased settlement in areas with coastal flood risk.

**Mangroves and Saltmarshes** - + Mangroves and saltmarshes can serve a similar purpose to seawalls and jetties, while also providing habitat, maintaining natural coastline processes, and improving water quality. Coastal wetlands provide natural protection against storm surges and sea level rise by acting as a natural buffer to wave energy. Studies have demonstrated that even small areas of natural wetland can increase the flood resilience of coastal communities. Natural dunes additionally offer protection against storm surges if they have not been heavily impacted by development. — Restoration of coastal wetlands can be challenging in areas with privately-owned shortlines, and often require site-specific considerations to be effectively implemented.



**Inland Wetlands** - + Similarly to mangroves, inland wetlands such as marshes, swamps, bogs, fens, and floodplains can act as natural floodwater buffers. Wetlands are able to temporarily store floodwaters, releasing it into rivers at a slower rate than impervious constructed surfaces that often replace wetlands. In other words, where surfaces such as concrete lead to immediate runoff, wetlands “dampen” the effect that intense storms have on watersheds, mitigating the conditions that lead to flash flooding.





**Elevated Structures** - + Elevating structures is a widely-utilized adaptation technique to prevent damage from flooding. Structure elevation is especially applicable to communities with a high amount of pre-existing structures and buildout, where relocation or new construction is not a viable option. — However, the cost of elevating structures can increase substantially the more they need to be elevated.

Additionally, elevating structures can impact accessibility and may introduce additional risks, such as floor rot or wiring issues.

**Green Roofs** - + Green roofs capture water when it rains, releasing it over time through evaporation, reducing runoff from buildings. Green roofs can additionally be utilized as rooftop urban gardens, can decrease energy use in buildings by regulating temperature, and can counter the Urban Heat Island Effect.

**Early Warning Systems/Evacuation Routes** - + Critical for protecting communities is having early warning systems for impacted communities and clear and effective evacuation routes. Increasing the flood resilience of roads, paths, and information systems are critical, especially as they relate to hospitals and emergency shelters.

**Climate Justice** - The impacts of flooding are disproportionately borne by marginalized communities. Mexico City is one community where the impacts of flooding are experienced more frequently and intensely by communities on the political margins of society. Due to constraints with the city's drainage network, engineers must choose floodgates to open and close to prevent infrastructure from being overwhelmed in the midst of a heavy storm. Engineers choose which neighborhoods to flood and how much flooding is acceptable based on the potential for political backlash. Those unaffected by flooding are thus unable to perceive the extent of the issue, and those affected have come to see flooding as a disruptive yet expected and mundane part of everyday life.

+ Bringing marginalized voices into decision-making processes is an important countermeasure to help prevent further desensitization to intensifying climate impacts.

## 4. Heat & Cold Resilience

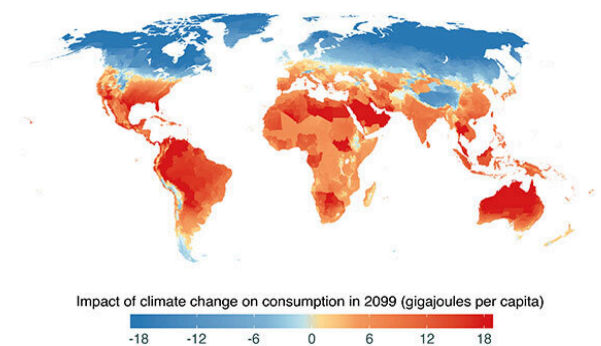
As with many climate impacts, heat waves are expected to grow more frequent and intense due to global climate change. Extreme heat is more potent due to the Urban Heat Island effect, where temperatures in urban areas can be up to 5 degrees C hotter than surrounding areas due to lower reflectivity (albedo), waste heat, and other factors. Extreme heat negatively impacts crop yield, biodiversity, the stability of power grids, and learning and productivity.

Extreme heat disproportionately affects marginalized communities due to differences in built environment and reduced access to healthcare, among other factors. Although the impacts of extreme heat pose a significant threat, there are key solutions that can mitigate risk and build resilience in communities. Many of these solutions come with co-benefits and also support communities' efforts to decarbonize. Several solutions are listed below with benefits (+) and limitations (—) highlighted, to serve as a starting point for creative content.

**Active Cooling** - Active cooling encompasses cooling solutions that require direct energy use, such as air conditioning. + Active cooling can serve as a vital layer of protection for protecting peoples' health. Air conditioning can be an important intervention to prevent heat-related illnesses, including heat stroke. Many urban areas have implemented Community Cooling Centers, cool spaces that are available to the public, to make air conditioning more accessible.

— However, active cooling comes with a key drawback: energy use from times of peak demand is often met by burning fossil fuels, meaning active cooling often directly contributes to climate change and further intensification of the Urban Heat Island effect. Additionally, not everyone can afford the energy needed to air condition spaces.

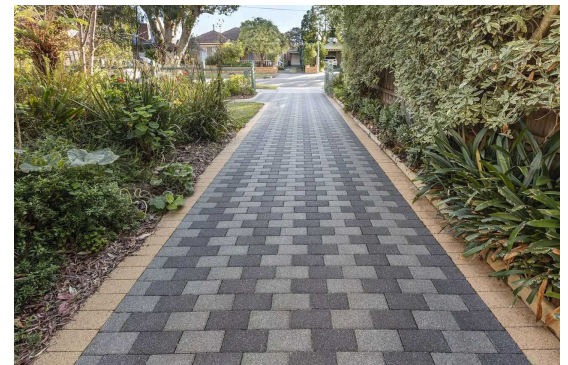
### Changing Demand for Electricity



Graphic prepared by the Climate Impact Lab

**Urban Greenery** - **+** Greenery in urban areas acts as a type of passive cooling, countering the Urban Heat Island effect without direct electricity use. Vegetation sequesters carbon and cools urban areas through shading and evapotranspiration, and by increasing the reflectivity (albedo) of surfaces. Urban greenery can also offer a number of co-benefits, such as local food production, cool spaces to exercise, and habitat/pollinator pathways. **—** Urban greenery needs to be cognizant of local conditions - retaining local biodiversity should be a priority, and greenery needs to be strategically placed in areas where it will be able to survive.

**Permeable Surfaces** - **+** Permeable surfaces absorb moisture and allow it to evaporate over time, reducing the surrounding air temperature. Soil is a classic permeable surface, though there are also permeable concrete and materials that replicate the functionality of their non-porous counterparts. **—** Permeable surfaces don't offer any cooling benefits while dry, and are often more expensive and require more maintenance than traditional materials.



**Energy-Efficient Building Codes** - **+** Building codes can ensure that buildings are constructed with thermal efficiency in mind. High-quality insulation can go a long way toward keeping indoor areas cool during heat waves, or at least reducing the amount of energy needed to cool indoor spaces with active cooling. **—** Building codes require a lot of regulatory oversight, posing a challenge for implementation in many countries.

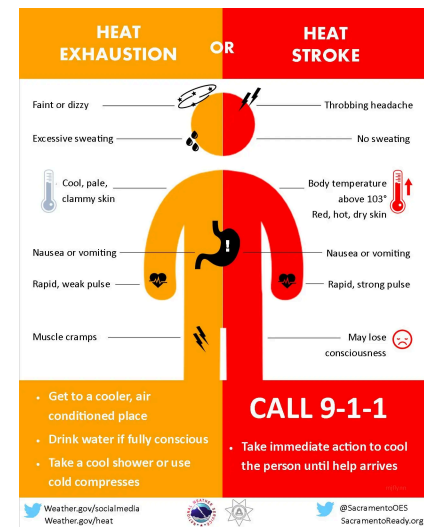
**Cool and Reflective Surfaces** - **+** Reflective surfaces are a cost-effective way to counter the Urban Heat Island effect, reducing the amount of heat absorbed by built infrastructure. Cool and reflective surfaces can be implemented in a variety of ways, including reflective roofing materials, reflective paints, and light-colored pavements. **—** Cool and reflective surfaces may be poorly suited for historical buildings and landmarks that benefit from tourism.



**Heat Warning Systems** - **+** Heat advisories and alerts can help raise awareness around the impacts of extreme heat and can help communities better prepare for the impacts. Similar to hurricanes, heat waves can be assigned categories to quantify the health impacts and the demographics that are most at risk.

**Symptom Recognition** - **+** Training people to be able to recognize the signs of heat exhaustion and heat stroke in themselves or others can ultimately save lives. The symptoms of each are as follows:

- Heat exhaustion: Dizziness, excessive sweating, nausea, weakness, clammy skin, muscle cramps, and a weak but rapid pulse. Heat exhaustion can lead to heat stroke if it goes unaddressed.
- Heat stroke: Throbbing headache, confusion, no sweating, hot/dry skin, a strong and rapid pulse, and a loss of consciousness. Heat stroke is a medical emergency.



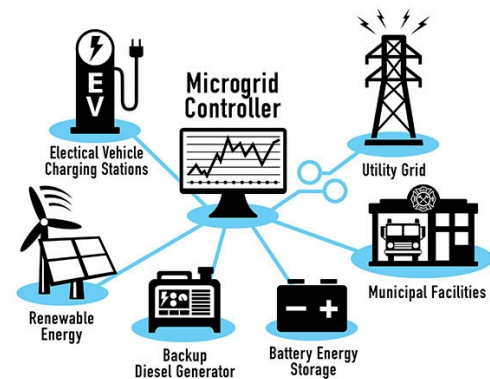
Extreme cold has a nuanced relationship with climate change. The world is warming on average, meaning the frequency and intensity of cold snaps is decreasing on average. However, the last few years have been riddled with intense cold fronts that have caught scientists' attention. Some models indicate that climate change may have a weakening effect on the northern jet stream that generally forms a barrier between Arctic temperatures and more temperate areas. Arctic warming is outpacing the global average by two to three times, lowering the temperature differential and potentially leading the northern jet stream to distort further south. However, the distortion could also be attributed to natural variability that isn't yet fully understood. Either way, it is clear that an overall warming trend hasn't ruled out sudden, unexpected cold fronts that can heavily impact infrastructure and catch communities off-guard. Once again, solutions to these impacts are listed with benefits (**+**) and limitations (**—**) highlighted.

**Extreme Temperature-Resistant Materials:** One challenge for building resilience to extreme cold is the fact that communities are also at higher risk of extreme heat, especially in urban areas. This increases the range of temperatures that built

infrastructure needs to be able to effectively withstand. **+** Deploying materials that better withstand both higher and lower temperatures can be effective for building infrastructural resilience to both extreme heat and extreme cold. **—** However, it may require significant resources and oversight to effectively update infrastructure.

**Building Insulation:** **+** As with extreme heat, building insulation can go a long way to ease the strain on power grids on cold days by reducing the amount of heating needed to keep indoor spaces comfortable. More broadly, any programs that help conserve energy to keep power grids stable during extreme cold can help keep people safe.

**Microgrids:** **+** Thanks to their distributed nature, microgrids can help mitigate the risk of blackouts and brownouts in the midst of extreme weather events, including extreme cold. Microgrids allow communities to connect and disconnect from the wider power grid to source power from local sources. In a traditional power grid, electricity is generally transmitted long distances from power plants to communities, which is more prone to interruption. **—** Microgrids come with a lot of benefits for resilience, but they can be expensive and complex to set up, posing a high barrier to entry for communities looking for low-hanging wins.



**Cold-Weather Shelters:** **+** As with community cooling centers, cold-weather centers can be a critical intervention to protect those who are at highest risk to extreme cold. **—** An important consideration for cold-weather shelters is transportation; communities need well-resourced plans in order to ensure vulnerable populations can access the shelter's services in the face of infrastructural disruptions and unsafe travel conditions.

**Emergency Preparedness Kits:** **+** Extreme cold can impact water, wastewater, and gas lines in addition to power grids, making emergency preparedness kits a necessity. Emergency preparedness kits can also play an important role in protecting people from other climate-driven impacts.

## 5. Wildfire Resilience

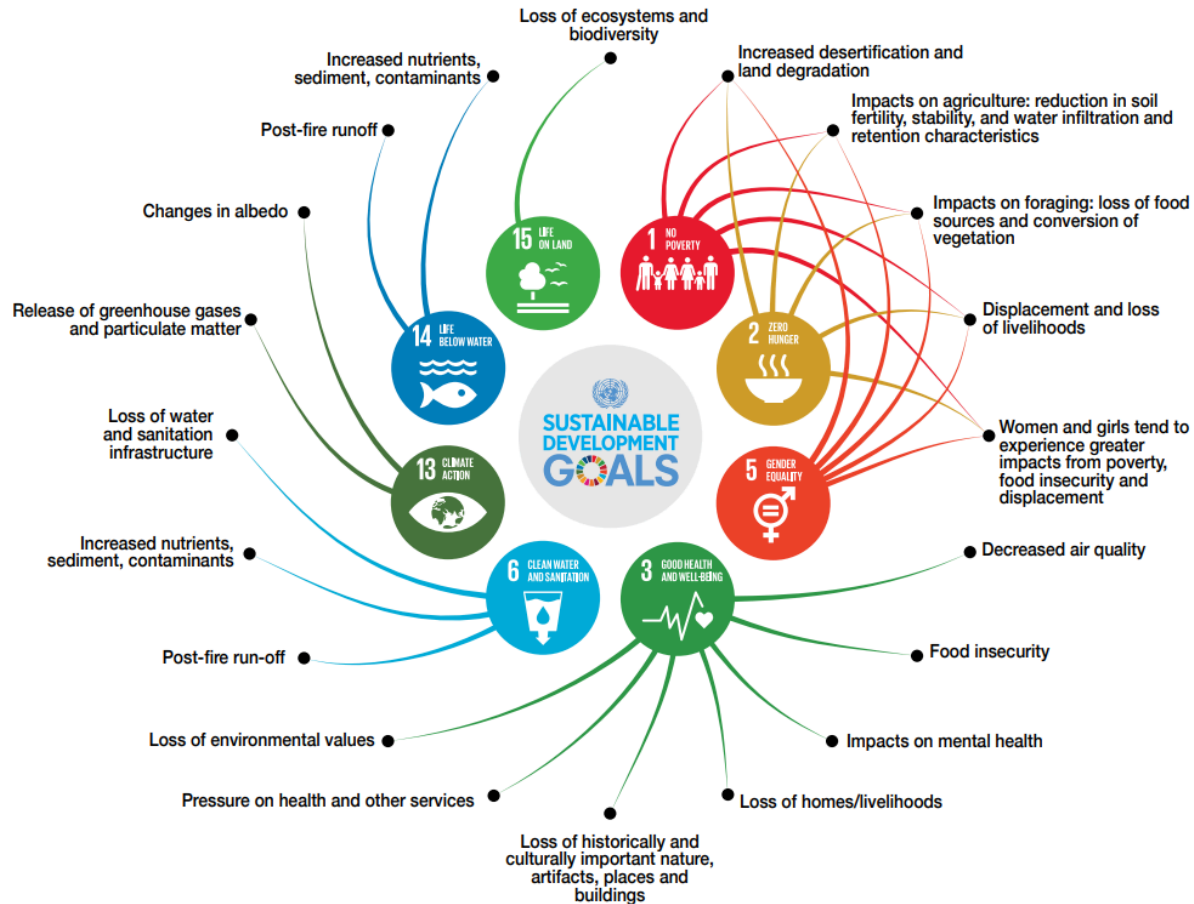
For those living in forested areas, wildfire is a persistent threat that has been intensified by a number of factors, many of which have been chronically worsened by climate change. These factors include:

- **Fuel aridity:** Wildfires are intensified when the organic matter that serves as fuel lacks moisture. A 2016 study from Abatzoglou and Williams suggests that anthropogenic climate change is a primary driver for fuel aridity, responsible for over half of the increase in observed fuel aridity in the western U.S. since 1979. Natural climate variability also strongly influences fuel aridity.
- **Fuel abundance:** Many communities, including those in the western U.S. and Canada, have suppressed wildfire for decades in ecosystems where fire is a necessary component of forest health. This has led to an unhealthy accumulation of debris that has intensified uncontrolled wildfires. Some impacts linked to climate change, such as high winds and insect outbreaks, also contribute to fuel abundance.
- **Land use change:** Changes in land use can worsen or mitigate wildfire spread and intensity, depending on the biome and change in use. Often, land use change refers to conversion of forested areas to crop or pastureland. Deforestation can reduce evapotranspiration, cloud cover, and precipitation in a region, further contributing to fuel abundance and aridity.
- **Invasive species:** Non-native plant and animal species can negatively impact forest health and contribute to wildfire ignition. Some invasive plant species, such as cheatgrass, are highly flammable. Other invasive species outcompete native flora, contributing to increased fuel abundance.

Mitigating wildfire risk means addressing each of these underlying driving factors, as well as equipping communities to protect themselves from the impacts of wildfires.

Below is a comprehensive visual connecting the impacts of wildfire to the UN Sustainable Development goals:

## Impacts of wildfire on Sustainable Development Goals



GRID-Arendal/Studio Atlantis, 2021

As a wide variety of factors drive these impacts, this also means there are a myriad of solutions that can mitigate wildfire intensity and build resilience in communities. Several solutions are listed below with benefits (+) and limitations (—) highlighted, to serve as a starting point for creative content.

**Reduction in CO<sub>2</sub>-equivalent Emissions** - Since anthropogenic climate change is linked to multiple factors driving increased wildfire intensity, reductions in carbon dioxide, methane, and other greenhouse gas emissions are critical. One way to conceptualize climate change is as a threat multiplier, making it more common for climate conditions to favor wildfire ignition and spread. + Reducing CO<sub>2</sub>-equivalent emissions mitigates future climate change and by extension the increase in frequency of fire-favorable weather conditions. — However, it will take years of reduced CO<sub>2</sub>-equivalent emissions before the current trend of global warming is affected, and

the impacts of climate-intensified wildfires are felt here and now. Other mitigation solutions are urgently needed to protect communities in the interim.

**Fire Suppression** - The elephant in the room for community protection from wildfire is fire suppression, which refers to a set of activities that seek to control the spread of wildfires. Fire requires three ingredients to spread: heat, oxygen, and fuel, and fire suppression efforts generally target at least one of these three ingredients. + Thanks to fire suppression activities, less than 10% of ignitions escape initial containment in the U.S. and Canada. — However, as mentioned before, a legacy of fire suppression can lead to fuel accumulation in fire-dependent ecosystems. Without additional measures, fire suppression can make the less than 10% of ignitions that escape initial containment much more challenging to control. Additionally, effective fire suppression requires a level of investment that many developing countries are unable to provide, leaving many global fire response organizations understaffed.



**Controlled Burns** - Many indigenous peoples around the world have practiced cultural burning for centuries, setting low-intensity controlled fires to manage forest health. + Today, indigenous-led controlled burns are recognized as a vital activity to counteract fuel accumulation from fire suppression. Blending place-based knowledge with modern technical capacities has proven a potent combination for managing wildfire risk, while also supporting indigenous communities culturally, economically, and politically. — However, adoption of such practices is slow in some governments and communities, with some indigenous leaders remaining skeptical in their ability to influence long-term decision-making.

**Fragmentation** - Intentional or unintentional fragmentation of burnable area has a complex effect on wildfire risk depending on the biome. — Often, ecosystems are fragmented through urbanization and land use change, which can negatively impact biodiversity and forest health, alter weather patterns, and increase flammability. Fragmentation in dense forest biomes can also increase the number of ignition points

where wildfires can start. + On the other hand, fragmentation in savanna biomes where vegetation is already sparse has been shown to have positive effects for wildfire mitigation, inhibiting the spread of fire. Natural and manmade fire breaks, or gaps in vegetation, can act as a vital layer of protection for communities.

**Ignition Mitigation** - Some activities can reduce the risk of fire ignition, including community education programs, seasonal regulation of high-risk activities (such as open flames during fire season), seasonal access restrictions (such as campsite closures), and maintenance or undergrounding of energy infrastructure. + Many of these activities are simple interventions that seek to address the hazard from the source. — However, interventions targeting infrastructure and behavior change are never foolproof, and some ignition sources (such as dry lightning) simply cannot be prevented. Additionally, to be effective, community engagement programs and communications need to be inclusive and appropriately tailored to their target demographic.



**Emergency Response Planning** - + Critical for community resilience to wildfire are early warning systems, emergency alerts, and well-organized evacuation routes. As with ignition mitigation, communications around emergency response need to be inclusive and available in a variety of formats and languages.

**Emergency Kits** - + Wildfires can cause disruptions to power and clean water infrastructure and supply chains, making emergency supply kits essential. Emergency kits can reduce dependency on emergency response professionals, increasing their capacity to get ahead of emergencies elsewhere.



## 6. Protecting Biodiversity

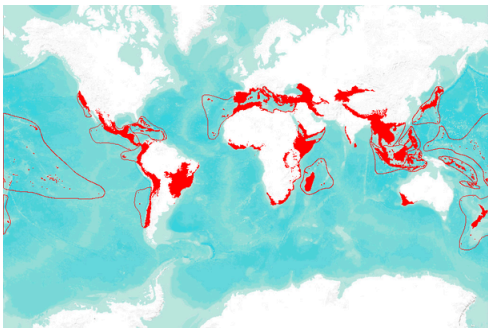
Biodiversity, or biological diversity, refers to the variety of plant and animal species on Earth. From microscopic organisms that maintain fertile soils to plant life that supports pollutant-filtering water cycles, our communities rely on a vast number of species for our well-being. However, human impacts threaten biodiversity and the services it provides us. The primary drivers of biodiversity loss include:

- **Human land use:** Conversion of land for agriculture or urbanization can wipe out critical habitat for species, driving many to the brink of extinction. Human activity has altered over 70% of all ice-free land and is estimated to be responsible for 30% of biodiversity decline globally.
- **Overharvesting:** Natural resources are limited, and if a resource is harvested faster than it can regenerate, both the resource and the species that are dependent on it are put at risk. This includes overharvesting of timber, overfishing, and overhunting. Overharvesting is estimated to be responsible for 20% of biodiversity decline globally.
- **Climate change:** Changing weather patterns can make habitat no longer suitable for certain species, resulting in biodiversity loss. Conversely, climate change can make habitats more suitable for invasive species that outcompete native species and diseases that lead to mass mortality events.
- **Pollution:** Fertilizers, pesticides, and other chemical byproducts can directly impact plant and animal species, impacting individuals' lifespan, rate of reproduction, and ability to remain competitive. Microplastics are also thought to negatively impact biodiversity, though the exact impacts are unclear.

In turn, biodiversity loss has implications for climate change and community resilience to its impacts. Biodiverse ecosystems such as wetlands and rainforests naturally draw carbon out of the atmosphere and store it in soil, in addition to supporting the water cycle and acting as natural flood barriers. Some species, called keystone species, play a vital role in managing populations of other species, such as predators that keep

populations of prey under control. The loss of one species can thus have cascading consequences, including for long-term storage of carbon.

The stakes are high, but there are actions we can take as individuals and communities to protect biodiversity. Many of these solutions target the underlying factors of biodiversity loss listed above. By showcasing these solutions in game content, we normalize them in public discourse. Below are solutions both old and new with various benefits (+) and drawbacks or limitations (—), to serve as a starting point for creative content.



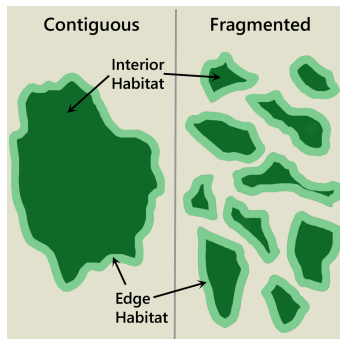
**Protection of Biodiversity Hotspots** - Biodiversity hotspots are regions that are rich in species found nowhere else on Earth (*endemic* species), but have lost over 70% of their original natural vegetation due to human activity. These hotspots account for 2.5% of the Earth's surface but are home to over half of the world's plant species and over 40% of animal species.

There are 36 hotspots around the world, which can be viewed with this [interactive map](#). Strategies that help protect biodiversity hotspots include:

- **Protected areas:** Governments can restrict activities that would negatively impact biodiversity hotspots by providing clear guidelines and delineations. For example, fishing may be prohibited in demarcated marine protected areas, and grazing may be prohibited in wildlife reserves. + Legal protections can go a long way toward minimizing harm to already endangered hotspots. Protected areas can still generate economic value through research and tourism.  
— Enforcement can potentially be expensive or controversial.
- **Sustainable forestry:** One of the largest drivers of biodiversity loss historically has been deforestation. Old-growth forest supports biodiversity more effectively than new-growth forest due to tree size, accumulation of material, and number of canopy layers. Unfortunately, some government programs such as India's Compensatory Afforestation Programme - which allows old-growth forest to be

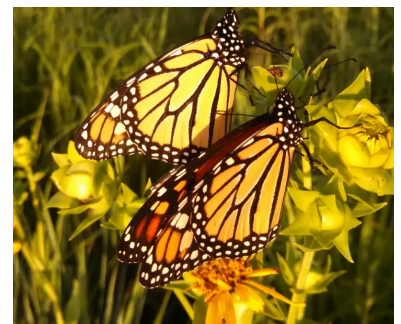
cut down as long as twice as much forest is replanted - haven't effectively accounted for this difference in ecological quality. + Protecting old-growth forest also protects the economic value they provide to local communities.

- **Local autonomy:** Supporting local decision-making is often a vital step for protection of biodiverse ecosystems. Many top-down conservation programs have encountered resistance from local communities as they either fail to achieve adequate protection, or they protect ecosystems at the expense of the local community. + A [2021 study published](#) in Ecology & Society reports that only 55.9% of locally controlled interventions had evidence of positive ecological **and** social outcomes, compared to only 15.7% of externally controlled cases.



**Wildlife Corridors/Pollinator Pathways** - Many animals migrate during their lifecycle, sometimes traveling thousands of miles to reach feeding or breeding grounds. Insects such as monarch butterflies need areas to feed and rest, fish such as salmon need to be able to navigate upstream, and mammals large and small need ways to safely navigate past roads. Many cities have taken to constructing pollinator pathways (pollinator-friendly greenery in public spaces) and wildlife corridors

(designated over/underpasses, ladders, and intact highways of undisturbed forest) to provide safely navigable routes. + Wildlife corridors can be especially important for predators as habitats become more fragmented. Animals near the top of the food chain tend to take up more space per individual. Connecting many small habitat 'islands' encourages more movement and disbursement of individuals, bolstering genetic diversity and species resilience. — Even when connected, fragmented habitats can still impact biodiversity as some species thrive more in deeply isolated interiors, versus adaptable species that can outcompete them around the edges of the habitat. Wildlife corridors thus shouldn't be considered a suitable replacement for larger habitats.



**Invasive Species Removal** - Invasive species are species that are foreign to a specific region but nonetheless thrive, often outcompeting native species and contributing to biodiversity decline. Invasive plant species can gain a foothold in a region through burn scars, landslides, and other disruptions that offer prime opportunities for new growth.



Invasive species are most problematic on islands where native species often haven't evolved defenses to being consumed, making them easy prey. Approaches to invasive species removal include:

- **Manual removal:** + Physical removal of invasive species is often the most direct route toward ensuring ecosystem resilience. — Due to the scale of the problem, this can be costly, labor-intensive, and temporary, making it more suitable for damage control.
- **Biological control:** + In some cases, invasive species may have a natural predator that can be introduced to control its spread. — Introducing new species has to be done with great care to ensure the introduced species doesn't become an invasive species of its own, or otherwise crowd out native species.
- **Chemical control:** + Some invasive species can be targeted directly with pesticides or herbicides. — However, chemical pollution is a factor that can directly impact biodiversity, so great care must also be taken with its application.
- **Cultural control/policy:** + The general public can be a potent force for invasive species prevention and extermination. Some invasive species have been successfully removed through policy and public awareness campaigns that incentivize hunting invasive species and taking actions that help prevent their spread.

## 7. Cultivating Community

***“Relationships are built at the speed of trust, and social change happens at the speed of relationships.” -Rev. Jennifer Bailey***

Community-building is one of the most powerful tools we have to drive forward climate action. Widely used in the U.S. during the civil rights era, community-building has been the backbone of many successful movements, including the end of racial segregation, women’s suffrage, and early environmentalism. Activism was strong because the communities backing it were strong, enabling leaders to bring about great change.

Today, we find ourselves in a much different context. With digital technology, the way we communicate with each other and form bonds with others has changed. Lockdowns during the Covid-19 pandemic further accentuated this trend, leading many to feel disconnected and isolated. On the flip side, digital technology has made it much easier to find like-minded people and form close-knit communities around specific interests, beliefs, and skills - even if the group is globally distributed.



**So, why is community-building so relevant to climate change?** As you likely know, climate change can be a charged and polarizing topic that most people tend to avoid in casual conversation. Not only is it a complex topic involving existential risk, but it has been politicized such that acknowledging its very existence can threaten some peoples’ group identity. According to the Yale Program on Climate

Change Communication, two-thirds of Americans say they “rarely” or “never” discuss global warming with family and friends, even though a majority of Americans (64%) say they are at least “somewhat worried” about global warming (Yale Program on Climate Change Communication 2024). Similar studies on a global level have identified a “perception gap” where people tend to greatly underestimate the number of people around them who care about the impacts of climate change.

Cognitive scientist Dr. Pooja Paul explains that this perception gap “is a big problem because as humans, our behavior is finely calibrated to our perceptions of how others typically behave. And so, when we underestimate others’ willingness to act on climate, it actually dampens our own motivation to act” (Paul 2024). This gap in perception is a big problem when we need increased civic participation from everyday citizens to shape local and national policies on climate change. Luckily, the civil rights era offers us a number of tools we can use to bridge this gap, and building community is one of them. With this background, let’s look at a few different areas in which community-building is relevant in the context of games:

**Community management.** When you think of community-building and game development, creating a community around your game might be what first comes to mind. Community managers have a unique opportunity to build pro-environmental values into the fabric of their online communities. The [Environmental Game Design Playbook](#) (EGDP) describes this as “The Metagame” of climate game design, in which building communities “can help players acquire new patterns of behavior and action by socially supporting and affirming the value of those behaviors” (Whittle et. al. 2022). I recommend browsing the EGDP for tips on how to build effective communities if this is something you’re interested in.

**De-escalating Differences in Opinion.** Communities built around digital games are often online. As mentioned above, this can be advantageous insofar as it can make it easier to find like-minded people. However, there’s a growing awareness that this is a double-edged sword. By only ever interacting with people who are like-minded, we risk missing out on developing the social skills we need to connect with those whose perspectives differ from our own. At worst, this can manifest as online echo-chambers that build a base by affirming extremist views. At best, this can make it more challenging for activists with the same goals but different





methods for reaching those goals to trust each other. As developers, we can de-escalate differences in opinion in a number of ways:

- + Encouraging players to be part of multiple communities.
- + Exposing players to characters who have an opinion that might differ from their own but are shown to have a strong moral compass.
- + Modeling respectful disagreement between characters who are otherwise friends/allies (or even just working toward a common goal).
- + Encouraging players to seek out other opinions and be curious about where their own opinions come from.



**Building Local Community Power.** Global advocacy is important, but is no substitute for advocacy at the local level, where organizers can engage with their local communities and advocate for climate policy that meets their community's unique needs. In [Gaming for Climate Action](#), Trevin York et. al. examine a fascinating case

study of the energy transition in Puerto Rico. They explain that “one of the reasons Puerto Rico’s new, resilient solar-powered imaginary is so successful is that it is not monolithic. While the shared hope and vision for the future is widespread, this imaginary has room for local communities to adopt and adapt it for their specific circumstances” (York et. al. 2024). In other words, local climate advocacy groups around the world play a vital role in adapting global visions of sustainability to their local context. In this light, the distributed nature of online communities can also be a double-edged sword for climate action. With digital technology, social media, and the rise in remote work, we have arguably grown increasingly disconnected from our local communities. How can we address this through our games?

- + Building games that are location-specific, or have a social aspect (tabletop games are a natural fit for this).
- + Exposing players to historical examples of how local activism has led to global change.
- + Helping players develop social skills that are transferable offline.

**Emphasizing Values.** Whether you're building a community around your game or setting players up for success elsewhere, acknowledging values is a powerful way to forge connections. Emphasizing values in your games can prompt players to reflect on their own values and how they're acting on them, or build trust with you as the developer. For example, consider the following two statements:

*A: I believe that reducing carbon emissions will help us thrive in the future.*

*B: I value safe and healthy communities, and believe that reducing carbon emissions will help us thrive in the future.*



Adding a value statement establishes common ground, even if your audience disagrees with your belief. Emphasizing values is a way to invite further dialogue and emphasize what we have in common over what divides us. So what are some ways we can do this in our games?

- + Having players practice communicating their own values.
- + Including characters who have values that guide their actions.
- + Modeling use of value statements to bring characters together around a common cause, even if they disagree about some things.

## 8. Representing Future Stakeholders

**“We do not inherit the Earth from our ancestors; we borrow it from our children.”**

**-Time traveler (aka unknown origin)**



Our actions today have profound implications for the future. In the immediate future, how we adapt to a warming world will be the difference between life and death for those who are already experiencing climate-intensified disasters. In the longer term, the amount of greenhouse gas reductions we make today influences how severely future generations will be

impacted by climate change. Despite this, the upfront costs of climate mitigation and adaptation are significant barriers to action. There are legitimate competing interests for present-day funding, and also an overrepresentation of short-term over long-term interests within decision-making bodies.

This is one way in which climate change is a *representational* issue; those who have the most to gain or lose from our decisions (future generations) do not have a seat at the table. Barring the advent of time travel, there's not much we can do to have a dialogue with stakeholders who don't yet exist - and yet, we have the power to advocate on their behalf. Let's dive into some of the innovative approaches that communities are taking to advocate for future generations, including benefits (+) and drawbacks or limitations (—) of each approach.

**Seventh-Generation Principle** - With roots in Haudenosaunee (Iroquois) philosophy, the Seventh-Generation approach to decision-making considers how a decision will impact the next seven generations of stakeholders. Other Indigenous cultures around the world, such as the Worimi people of Northern New South Wales and the Māori, share similar concepts. + Seventh-Generation thinking has often been applied to resource conservation, including energy and water, and the impacts of environmental

pollutants. There is also a growing movement to incorporate the Seventh-Generation Principle in economic decision-making.

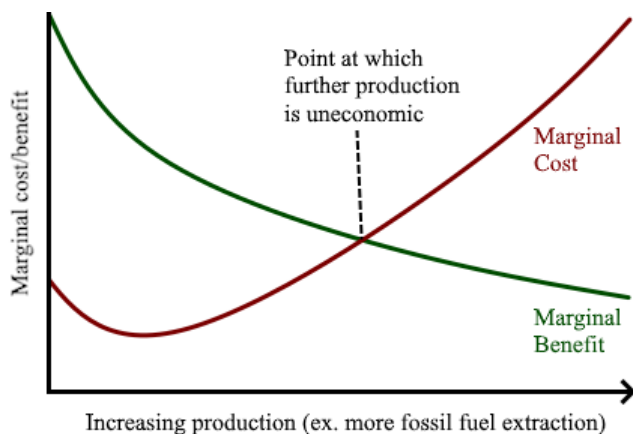
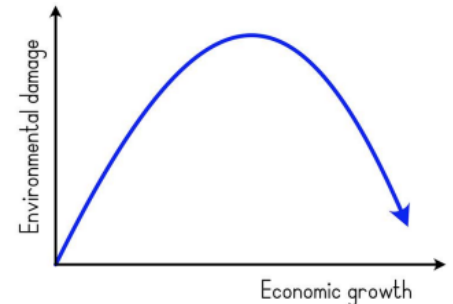


**Pricing Externalities** - The market economy was designed under the assumption that what's good for business is what's good for society as a whole. This alignment between self-interest and societal well-being is what Adam Smith coined the "invisible hand" - an inevitable trend toward prosperity through the free trade of goods and services. Under this model, a dollar earned is a dollar of good done for society, and businesses can maximize the good they're doing by maximizing their profits.

In theory, this is true if profits accurately reflect the net value of a good or service to society. In practice, many business activities carry hidden costs (and benefits) that are not factored into transactions. These are called *market externalities* as they are external to the market economy. Examples of negative environmental externalities include air and water pollution, industrial waste, ecosystem degradation, and greenhouse gas emissions. In general, businesses have an incentive to profit off of the "goods" they produce, but have a disincentive to pay the true cost of the "bads" - else they risk being outcompeted by another business with less care for externalities. This can lead to *market failure* and a "tragedy of the commons" where what's good for business is bad for society as a whole. Those with the least power to protest and enact change tend to be those who are most heavily impacted by externalities. + One way to address externalities is to put a price on them, thus making them part of the market economy. This is the basis for policies like carbon taxes, which focus on "fixing" misalignment between profit and social good.

— Central to the conversation around the economics of climate action are a few underlying assumptions that continue to spark intense ideological debate. There are limits to the kinds of questions economics can help us answer on its own. Consider how one's beliefs on the following might influence what makes the most sense economically:

**Will the future follow the same economic trajectory as the past?** The answer to this question shapes whether the negative impacts of externalities might outweigh the future positive impacts of free markets. Some economists such as Steven Landsburg argue that just as we are much better off than our ancestors, economic growth will make future generations significantly wealthier than us - and so it makes economic sense to pollute now and clean up later. Commonly cited with this notion is the *Environmental Kuznets Curve*, a theory that economic growth deteriorates the environment initially, but then enables environmental restoration. In studies of local and regional pollution, the EKC has been observed in some cases. However, whether the EKC is universally true continues to be unclear, with many recent literature reviews indicating mixed results. Nevertheless, many mainstream economists hold the notion that environmental degradation is a temporary 'phase' in a continually growing economy, and that we can rely on future economic growth to clean up the mess.



Other economists argue that the past is in no way indicative of the future. Ecological economists such as Herman Daly argue that just as we tend to address our most pressing needs first when given the resources to do so (*decreasing marginal benefit per unit of production*), it makes sense that we would also tend to displace costs to where they will cause us minimal harm (or to those with the least means to protest) until we start running out of options (*increasing marginal cost per unit of production*). In other words, just because something has been good for us, like burning fossil fuels, doesn't mean it will continue to be good for us.

Those who see this concept reflected in certain industries (such as fossil fuel production) might advocate for *green growth*; that is, shifting production to industries where negative externalities are mitigated or even supplanted by positive (regenerative) externalities. Others see this concept reflected in the growth of gross domestic product (GDP) as a whole, calling for new indicators of societal welfare (*post-growth economics*) or even *degrowth* in how much we produce and consume. How decision-makers think about

our future economic trajectory directly shapes the discount rates they set, with more optimism for future economic growth corresponding to higher discount rates.

**Fun fact:** Simon Kuznets, a Nobel Prize-winning economist who was instrumental to the development of GDP, warned that “the welfare of a nation can scarcely be inferred from a measurement of national income as defined by GDP.” Kuznets also created the Kuznets curve as a hypothesis for income inequality, which he described as “perhaps 5 percent empirical information and 95 per cent speculation, some of it possibly tainted by wishful thinking” (Kuznets 1955). Talk about your words not being heeded!

### ***To what degree will new technology solve our problems?***

Some economists argue that negative externalities create markets for new products and technologies that will mitigate them. For the externality of carbon dioxide emissions, carbon capture and carbon offsets are two market-based interventions that have recently emerged. Critics argue that neither are developing at the speed or scale needed to address climate change. When time is a critical factor, how decision-makers think about technological innovation can also strongly influence how they think about externalities.



***How much risk is acceptable?*** Climate scientists agree that global warming will impact fundamental Earth systems, but as with any data-driven research, the threshold and rate at which they will change are subject to confidence intervals and vary from model to model. For example, the Amazon rainforest is projected to be much more vulnerable to dieback from other disturbances (such as deforestation and forest fires) in a warmer world, but different models indicate different critical thresholds that could be anywhere between 2-6°C above pre-industrial levels. Climate policy recommendations rely on different levels of confidence and likelihood, in which we must make judgement calls on behalf of future generations. This highlights the importance of *risk tolerance* when faced with uncertainty.

**Visualizing Nuanced Futures** - One way we can advocate for future generations is by helping players visualize the range of possible futures based on the actions we take today.





— Games have a tendency to visualize post-apocalyptic futures for a variety of reasons, but repeated exposure to a post-apocalyptic future can make it seem inevitable. The notion that climate breakdown is inevitable is known as climate doomism, and is arguably a bigger obstacle to climate action today than climate denial. Michael Mann, a prominent climatologist best known for the hockey stick model of climate

change, emphasizes that while the urgency for climate action is clear, there is no scientific evidence for catastrophic runaway warming. As Mann explains, “there are some bad actors who are promoting unhelpful framing to actually cause paralysis and disengagement...[and] a lot of those narratives are steeped in distortions of the science that are almost as bad, if not as bad, as distortions of the science on the denialist side” (Barnett 2021). + Instead, there are a range of futures in which future generations are heavily impacted by climate change but continue to display remarkable ingenuity and resilience. As storytellers, we can highlight the intergenerational implications of our actions today in a way that breaks the false dichotomy of climate apocalypse versus climate utopia. We can illustrate that future climate impacts are a sliding scale, not an all-or-nothing phenomenon, and that we have the agency to enact change.

**Youth Activism** - In Ashland, Oregon in 2024, local youth activists were granted a nonvoting seat at the table of a committee formed to make recommendations on climate policy to the Ashland City Council. Adults in the room were hesitant to recommend actions that might stir controversy or legal challenges, but the youth kept the discussion grounded in the risks associated with inaction. As a result, the committee recommended the boldest action possible to the City Council. This is just one instance of youth activists shaping public climate policy. + Including youth activists in decision-making processes is perhaps the closest thing to giving a voice to the needs and considerations of future generations. They can bring fresh ideas and a unique perspective to policy decisions that can enable better decision-making. — Despite this, youth activists are at high risk of being dismissed by adults as being inexperienced,



idealistic, or influenced by other adults with an agenda. Youth activists are, after all, still developing their skills, and it's just as important for youth activism to be rooted in rigorous research. It is also important to recognize that it is not solely the youth's responsibility to advocate for policy that represents the needs of future generations. The narrative that the next generation will solve the world's most pressing issues is troubling to many youth activists, who are putting themselves out there in order to get the adults in the room to act now.



### **Future Design Councils** - Building on the

Seventh-Generation Principle, Japan's Future Design movement brings together present-day citizen stakeholders with participants advocating on behalf of future generations.

✚ This imaginative exercise has already shaped public policy in several cities and multiple studies have been conducted to

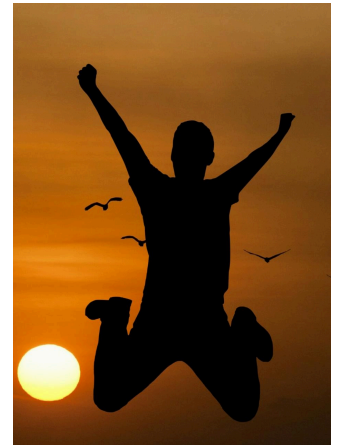
assess its impact. There are measurable differences in how participants thought about time as it relates to planning and investing. Rather than the Future Design workshop broadening participants' time horizons, researchers have found that traditional workshops tend to encourage self-interested individuals to "think more deeply about the current constraints that limit their welfare, such that they [give] higher priority to resolving these constraints" (Nishimura et. al. 2020). In contrast, a workshop incorporating Future Design mitigated this tendency, leading to more constructive policy proposals. — While the results are promising, researchers note that further studies are needed to establish Future Design debates as a common practice in democratic decision-making.

## 9. Sparking Joy

***“Climate justice is joy because the climate crisis is violence.”***

***-Ayana Elizabeth Johnson***

Joy may feel inappropriate amongst the backdrop of accelerating climate impacts. We may grapple with whether incorporating climate solutions into our games is making light of a serious issue. When peoples’ lives and livelihoods are at stake, is it really appropriate to make games about climate change? Does the seriousness of climate change conflict with the playfulness of games? Is our expertise of eliciting joy in players even relevant to climate action?



Luckily, we are not alone in answering these questions. Many in the broader climate movement are examining the role of joy in sustaining action, resulting in a wide range of perspectives, philosophies, and peer-reviewed studies. These perspectives can inform how we as game developers can seek to contribute to the broader movement. After all, we’re not making games in a vacuum. The more we can understand the full context we are situated in, the more effectively we can direct our time and energy toward meaningful change. Below are ways that we might support climate action by sparking joy, including potential benefits (+) and drawbacks or limitations (—) of each approach.



**Sparking Action Through Joy** - A recent study from Dr. Sabrina McCormick, Annette Aldous, and Laurilee Yarbrough followed over 350 participants before, during, and after watching three different video segments involving collective environmental action. Each group’s emotions were assessed before and after viewing, and each group then reported on their actions for 4 weeks.

✚ The results of the study suggest that out of all the emotions that can be elicited through media, joy may be the most effective in motivating climate action (with 99.9% certainty). Fear and surprise were also found to motivate climate action (with 95% certainty), but to a lesser degree than joy.

Dr. McCormick is a leading sociologist in climate communication, making this study an exciting development for those looking to make an impact through media. By making collective action a joyful experience in games, players may be more likely to take action and join efforts in the real world. This study suggests that we as game developers may be able to support climate action by simply doing what we do best - making fun games that spark joy. — It's worth mentioning that there are still some gaps in this research. Dr. McCormick et. al.'s target demographic for the study was not perfectly representative of the general public or video game players, leaving space for further work. How might we as game developers be able to measure how we make our players feel and how those emotions shape their actions?

## CLIMATE ACTION VENN DIAGRAM

BY DR. AYANA ELIZABETH JOHNSON



ART ADAPTED BY NICOLE KELNER

### Discovering One's Climate Niche - Dr. Ayana

Elizabeth Johnson is another trailblazer in climate communications. A marine biologist and bestselling writer, Dr. Johnson has adapted the Japanese concept of Ikigai (roughly defined as one's life purpose or motivating force) to help others answer the common question of: how can I help address the climate crisis? To answer this question, Dr. Johnson encourages everyone to answer three questions and then search for where they overlap:

- *What are you good at?*
- *What work needs doing?*
- *What brings you joy?*

✚ Discovering an action that fulfills all three criteria allows an individual to take regular steps toward transforming carbon-intensive systems. We can help players understand that there are ways to help beyond reducing one's carbon footprint. Instead, they can be using their skills to do work that needs doing through activities that bring them joy. How might we as creators and storytellers help players discover their unique niche in the climate movement?

**Preventing Emotional Burnout** - Lasting social change requires consistent advocacy from people of all backgrounds. However, even the most resilient of climate activists are susceptible to burnout. A recent study from Lucy Bird, Emma Thomas, Michael Wenzel, and Morgana Lizzio-Wilson examines burnout from climate change in great detail. They elaborate that people can burn out for a wide variety of reasons: outside opposition, setbacks to passing policies, perceived lack of impact, or intense negative emotions like eco-anxiety. Burnout has two primary components, which may also inform how we can go about preventing it:



Image: "Activist Burnout" by Susha Roy

- Disengagement, or the feeling of wanting to distance oneself from a source of stress. The study suggests that disengagement is mitigated by pragmatic thinking, or having a step-by-step plan to reach a desired outcome.
- Exhaustion, or the feeling of being emotionally depleted. The study suggests that exhaustion is increased by climate despair.

✚ Eliciting joy may be a powerful way to counter despair and by extension mitigate burnout in climate advocacy. We have an opportunity to apply our skills directly within the climate movement to make advocacy something that helps people recharge rather than feel depleted. On a neurological level, engaging in activities that bring us joy releases neurochemicals including oxytocin (often experienced as a warm fuzzy feeling), dopamine (experienced as motivation), and serotonin (experienced as



contentment and relaxation). These neurochemicals in turn can help prevent us from falling into despair and inaction. — While joy can be a powerful antidote to despair, it may also exacerbate it if it seems disconnected from reality. Toxic positivity can be a form of denial - and we don't have to deny our concern for the future to engage in joyful activities. Instead, our games can elicit the simple joy of being alive, the joy of the present moment, the joy of standing up for what is right, or the joy of organizing with like-minded people. We can acknowledge the weight of the climate crisis without giving into despair. How might we guide players into a similar space of grounded optimism through our games?



Image: "Mother" by Ariana Thornton

**Supporting Creative Thinking** - + Beyond preventing burnout, studies show that positive emotions can actually boost our ability to think creatively. Dr. Barbara Lee Frederickson is a social psychologist best known for theorizing that positive emotions, like negative emotions, have an important survival function. This function is to broaden our perspectives and build our personal resources (physical, intellectual, and emotional) so that we can more effectively respond to a wide range of situations. On the flip side, negative emotions narrow our attention to a specific situation that needs to be immediately addressed.

This is great for wild animal attacks from our hunter-gatherer days. For climate change though, outside-the-box thinking and trust-building are what we need most. How might we help players find the balance between feeling urgency for climate action (which is important) and feeling like they can take time for themselves to invest in their skills and well-being?



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