INTRODUCTION

This ludography was co-authored by researchers on the 'Play and the Environment: Games Imagining the Future' project carried out by the Manchester Metropolitan Game Centre and funded by Game in Lab and the Libellud Foundation in 2021 and 2022. The project team includes young co-researchers who participated in and facilitated hacking workshops with students in schools and universities in Manchester, UK. The ludography draws on the participatory methods developed through the project, which develops the new research method of game hacking (Germaine and Wake, forthcoming) alongside youth participatory action research (YPAR) methods.

LUDOGRAPHY SELECTION CRITERIA

The inclusion criteria for the ludography is informed by the individual and collective interests of the research team and includes games suggested by workshop participants. In the main, we have collected the details for a range of nature- and climate-themed board games. Also included are games with other themes that the project team, including young co-researchers, consider pertinent to the theme of climate change and so useful in engaging audiences with thinking about anthropogenic climate change and/or climate futures. Such games include those that are not explicit about human-nature relationships nor about the impact of human behaviour on the environment but which might be played and/or hacked to think about these things. Our ludography thus contains games that are about, among other things, dystopian futures, competition for resources, building, machines, and the expansion of industry. The team noticed that a genre of 'industry' games, including examples such as Martin Wallace's *Brass* (2007), had become prominent at the same time as 'nature' games and we identify this as an area for further study in terms of thinking through how the mechanics of such board games position players with respect to the environment, and how this compares with playing 'nature' games.

AIM, CONTENT, AND STRUCTURE

The initial section of the ludography is annotated and provides key information about the games we have researched in terms of the game type, audience suitability, mechanics and gameplay. Other resources such as how to play videos are included, with links to external websites. Along with this key information the researchers have reflected upon the affordances of each game for engaging with

ecological thought, exploring human-environment interrelationships, and countering dominant myths or patterns of thought about 'nature' that contribute to the lack of awareness about climate change, to ongoing habitat destruction and other human behaviors fuelling the climate crisis.

There is not much discussion of the material components of the games nor the ecological impact of their manufacture and distribution. This requires further research. As many of the games included here are eurogames they tend to favour wooden and cardboard components over plastic (Woods 2012: 81), which lends them a seemingly climate-friendly or sustainable aesthetic. However, very few companies provide information about the GHG emissions of their products nor the source of the materials used. Issues such as the use of plastic packaging and a tendency to overly large game box size and concomitant shipping emissions require empirical investigation. We would also like to further explore the impact of favouring wood over plastic in the production of components. For example, the use of wood in commercial game production is likely to perpetuate modern forestry management, which is responsible for ecosystemic damage and the destruction of ancient forest in favour of uniform and fast-growing non-native species valued for their value on the human market.

The aim of the ludography is not to provide a comprehensive list of climate games, nor to suggest that we can offer an objective evaluation of the games' scientific or ecological accuracy. It is not for us to say if these games are 'good' or 'bad'. Instead, we consider the possibilities and problems that have arisen during our gameplay sessions and hacking workshops. We sometimes suggest game 'hacks' as ways of exploring those possibilities and problems, and of further interrogating how game design might function to better help players explore the theme of climate crisis and imagine alternative futures.

HOW TO USE THIS LUDOGRAPHY

This is a living document. Annotated entries will be amended and new games added as our project develops and we invite further collaboration. You are reading version 1.1 of the document, published on 9/9/2022.

Authors: Seth Etchells; Chloé Germaine; Charlotte Gislam; Lucy Roberts; Paul Wake; Jack Warren

BOSK
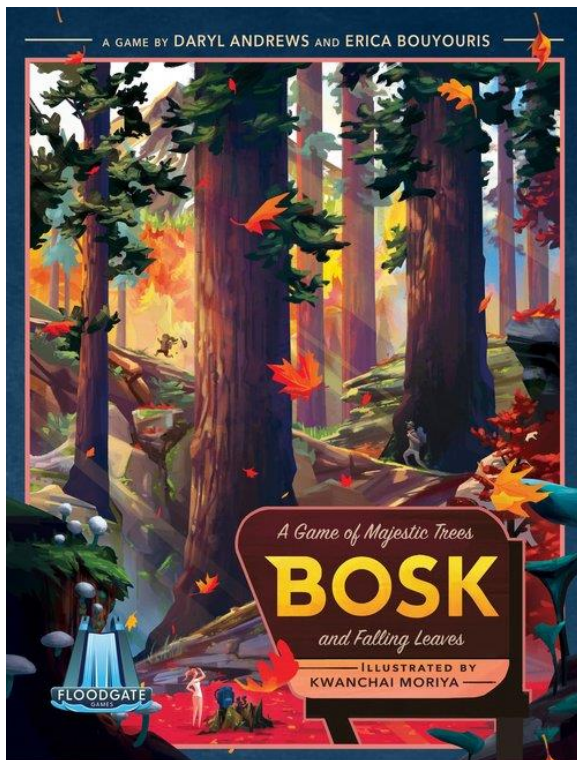
BOSK. Daryl Andrews and Erica Bouyouris. Art by Kwanchai Moriya. Floodgate Games, 2019.

**2-4 PLAYERS | 20-40 MINUTES | AGE 13+**

Bosk is a competitive area-control game set in a US national park in which players plant trees so that their falling leaves will dominate particular areas of the parkland and score victory points. 'Bosk' is a Middle-English word for thicket or wooded area and its etymology traces back to proto-Germanic languages. As Wohlleben notes, the early Germanic words for tree offer a possible root for the word 'book' (2021: 111-112), suggesting a connection between nature and culture made apparent in this game and other recent games that are interested in forests and trees, of which several appear in this ludography. In *Bosk*, 'natural' seasons are translated into game rounds and gameplay takes place over the course of a year in the national park. The objective of the game is to score points in Summer and Winter via the careful placement of each player's species of tree. In spring, players grow their trees tall, taking it in turn to place their trees along the trails. In summer, the value of each tree is added across each column and row, with the dominant species taking victory points. In Winter, the winds blow and leaves fall from the trees. The wind direction changes each round, demanding that players pay attention to the drifting leaves so that they can dominate a particular area of the forest, designated by coloured spaces representing different ecosystemic areas in the park (such as the river, the plains, etc.).

Unlike *Photosynthesis*, with which this game shares some aesthetic features, *Bosk* does not claim to simulate botanical processes; the life cycle element of the game instead centres on the value of each tree to the beauty of the national park, and their value is linked to the interest of human visitors. This is overtly represented by the first player marker -- the hiker -- who is used to track scoring in summer as it wanders the trail paths and admires the tallest trees. In its mechanics and goals, the game thus codifies the fact that seemingly 'natural' landscapes are managed by humans according to human tastes and interests. As Wohlleben discusses, for example, the trees of national parks in British Columbia are planted according to a landscape aesthetic designed to appeal to tourists, rather than in such a way that will encourage biodiversity and the health of the forest (2021: 185).

The other anthropocentric aspect of the game emerges from the way it encourages direct competition by species of trees. The goal is to become the dominant species whose falling leaves will cover those of the other trees. In our session, this encouraged aggressive play and suggested that the natural world is a site of zero-sum competition rather than a network of symbiotic and mutualistic relationships.

CANOPY
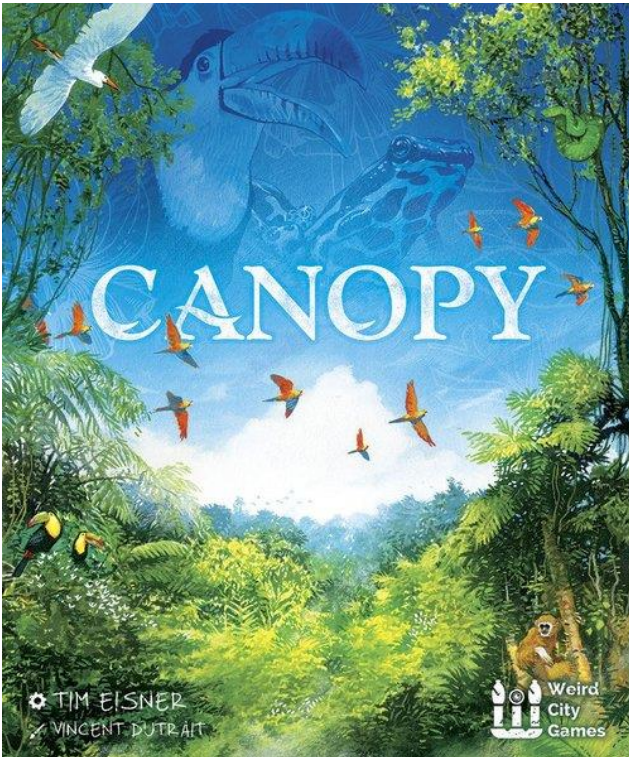
Canopy. **Tim Eisner. Art by Vincent Dutrait. Weird City Games, 2021.**

1-4 PLAYERS | 30 MINUTES | AGE 8+

Canopy is a card collecting game in which players take turns selecting new cards in order to grow a rainforest. The forest consists of trees, formed by trunk and canopy cards, along with animal, plants, and environment cards that interact with one another and score or deduct points from the forest total overall. Gameplay occurs over three years, with players picking consecutively from three growth piles. Each time you look at a pile, you may select it and add those cards to your rainforest tableau, or return the pile face down, adding one additional card to it for the next player to pick up.

The publisher describes *Canopy* as 'a game in which two players compete to grow the most bountiful rainforest.' The vibrant and photo-realistic artwork of 'tall trees' and 'lush jungle plants' evoke the rainforest as a dense, exotic and fully 'natural' space, devoid of human life or interference. Positive notions of ecology are evoked in the aesthetics and the rules, which state that the 'jungle ecosystem is full of symbiosis and mutualism, and players must grow tall trees and lush jungle plants to attract the most diverse wildlife. By carefully selecting what grows in your forest, you can create the ideal balance of flora and fauna and develop a thriving rainforest.' The language of natural abundance, evoked in the words 'lush' and 'balance', and the card-scoring mechanics suggest that a key feature of ecosystems is their networked nature, something that contemporary nature writers such as Wohlleben (2018) and Sheldrake (2020) are keen to emphasize as key to tackling climate change. *Canopy* thus makes into a ludic feature the relational nature of ecosystems and does not privilege the tall trees of the rainforest as the dominant means of point scoring, as is the case in some other nature games featuring trees discussed elsewhere in the ludography (see, e.g. *Sequoia* and *Photosynthesis)*. However, in its emphasis on mutualism and symbiosis, Canopy perpetuates what John Kricher calls the myth of the 'balance' of nature (2009). As Kricher notes, in popular ecology the 'biodiversity of the forest is in a kind of stable, long-lasting equilibrium', a notion that has been largely discredited in favour of the idea that forests, along with other kinds of ecosystems are dynamic and changing (2009: 17). The replayability of the game and the random element involved in what cards might feature in each growth pile does, to an extent, model this kind of unpredictable dynamism.

In our play sessions we discussed the role of the human in the game and how the player is positioned in relation to the natural subjects depicted on the cards. We thought that an interesting feature was the relatively passive nature of the player, who has limited choices in terms of actions and must pick up all cards from one of the growth piles and place them into their rainforest whether they like the selection or not. This mechanic suggests that the player is not a forest manager, since much of the

player choice and agency in the game is foreclosed. The unpredictable proliferation of life is simulated quite nicely through these mechanics: the human player gets a limited choice as to how many ferns, disease cards, tree, boas, and other creatures or plants they end up having to place into the forest.

What is significant in the game is the lack of any representation of the human, nor of interspecies relationships beyond those between plants and smaller animals. *Canopy* thus elides the ways in which the rainforest has been an economic, political and social space for hundreds of years, not only for indigenous peoples, but, since the encroachment of colonialism and capitalism, also a space for industrial-scale logging, agriculture and resource extraction. The rainforest has never been a simply 'natural' site devoid of humans. This myth of untouched nature is unsettling. In *Canopy*, for example, drought, disease and forest fires are represented as purely emergent natural disasters, as opposed to themselves being part of shifting conditions of the ecosystem as it interacts with wider climate, social, and economic systems. We discussed hacks that would add cards to the game to reimagine the rainforest as an 'anthropogenic biome' -- a term used by ecologists to shift understanding toward the fact that human and ecological systems are integrated not separate (Ellis and Ramankutty 2008) -- and that explored the ecosystemic interactions of humans and more-than-humans, perhaps introducing economic and social activity as imbricated with the 'natural'.

CATAN
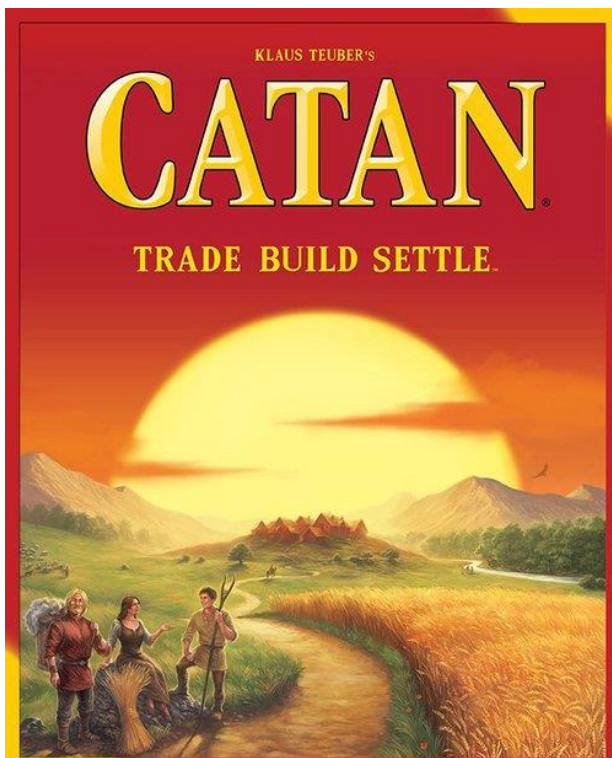
Catan. Klaus Teuber. Catan GmbH, 1995.

3–4 PLAYERS | 60-120 MINS | AGE 10+

Catan, designed by Klaus Teuber, is a multiplayer game in which players compete to create the dominant settlement on the fictional island of Catan. Players compete for space and resources, and build roads, towns and cities until the island has been effectively colonised (where, as Greg Loring-Albright has asked, are the island's indigenous peoples?). With resource gathering, trading and building as its core actions the game is well suited to discussions of sustainability and climate change and given its popularity it is unsurprising that the game has been the subject of discussions of sustainability (Assadourian and Hansen 2011; Chappin, Bijvoet and Oei 2017). There are a number of expansion and scenario packs that have previously been developed for *Catan*. Notably these include Catan Scenarios: Oil Springs [Assadourian and Hansen, 2011], which introduced oil as a tradeable resource and which explores environmental degradation and the unofficial free scenario Catan: Global Warming [Illingworth and Wake] which focuses attention on the complex interplay of individual and collective actions in the process of global warming.

ECOSYSTEM
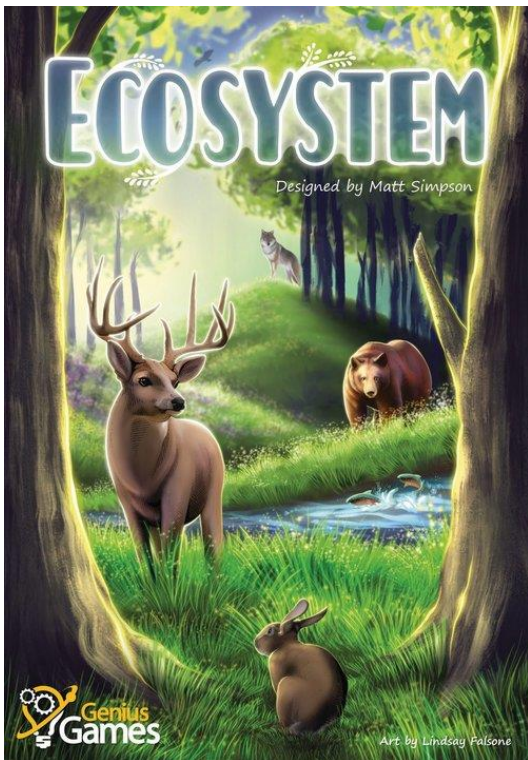
Ecosystem. Matt Simpson. Art by Lindsay Falsone. **Genius Games**, 2019.

2-6 PLAYERS | 15-20 MINUTES | AGE 10+

Ecosystem is a card-drafting game in which players must place cards in a 5 x 4 grid to cultivate their own ecosystem. The objective is to score points by positioning certain cards next to each other: bees will score points by being adjacent to meadows; trouts score points by being adjacent to dragonflies and streams; while predatory bears want to be adjacent to trout and bee cards. Diversity is also a key point-scoring mechanic, as the more meadows, streams, animals, and insects in the player's ecosystem, the more points they will score; ecosystem gaps result in fewer points overall. *Ecosystem* supports two to six players, and each game is short, typically lasting around fifteen to twenty minutes. The cards are smaller than an average deck of cards, so the game can easily be played on most tables or desks.

Ecosystem is a competitive game rather than collaborative, as there is some competition for resources (the individual cards), and there is the potential to deny other players these resources. However, denying resources is often accidental since players will be primarily focusing on their personal ecosystem. Aesthetically, *Ecosystem*'s cards feature vibrant depictions of animals, insects, and geographic features, fostering affectionate feelings when placed within an ecosystem. Although since each card is prescribed a score, and the player with the highest score will be the winner, the card's value rather than its connection to nature might take precedence during gameplay. Further, *Ecosystem* represents only a small segment of North American or Northern European ecosystems. However, homemade cards with unique rules could easily be added, for example, a mycelium network, represented by mushroom cards that boost points if they are spread out through the player's ecosystem. Or small seed-eating birds, such as finches, that when placed adjacent to meadow cards cause them to spread. Otherwise, *Ecosystem's* mechanics make the player pursue diversity and balance in their ecological microcosm, which is deeply evocative of the importance of such pursuits in broader ecological thinking. For details on how the young people at St Peter's RC High School played and hacked *Ecosystem* in our workshops, see: Games Imagining the Future project update.

FORBIDDEN ISLAND
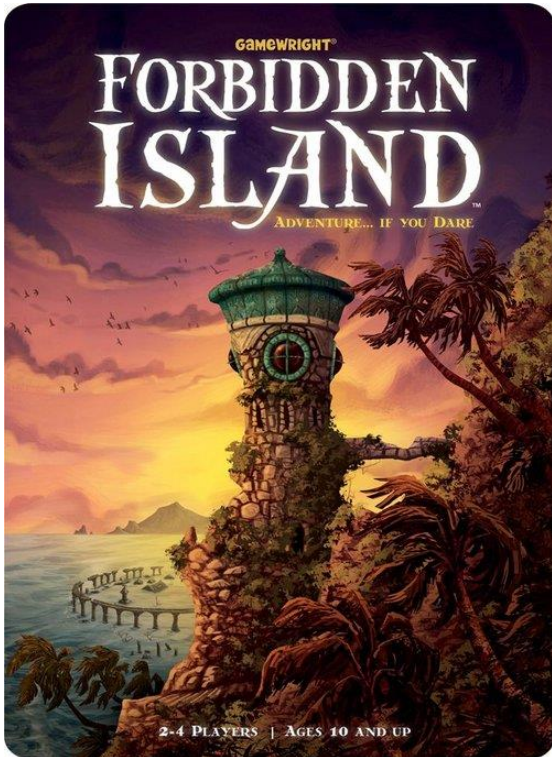
*Forbidden Island*. **Matt Leacock. Art by C. B. Canga.** **Gamewright**, **2010.**

2-4 PLAYERS | 30 MINUTES | AGE 10+

Forbidden Island is a collaborative game during which players work together to collect four treasures from a fantasy island and escape before the island sinks under the water. Players take turns moving their pawns around the island, which is not a traditional game board but a map built by arranging the tiles randomly before play begins. As the game progresses, more and more island tiles sink, becoming unavailable, and the pace increases. Players take actions (which include moving, shoring up tiles, and swapping resources) to keep the island from sinking, while trying to collect treasures and items. After each turn, tiles continue to flood, with water level rises increasing the number of flooded tiles following the appearance of a dynamic event card. As the water level rises, gameplay gets more difficult and sacrifices must be made: the island cannot be saved but certain tiles can be protected until the treasure has been extracted.

Workshop participants identified this game as generative for discussions of the climate emergency, even though it is not explicitly themed around nature or climate change and is seemingly set in a secondary fantasy world. On a surface level, the game prompts discussion about rising sea levels across the globe already underway and projected to become much worse in the next few decades. Project participants suggested that the game positions players in a combative relationship against the natural world, which emerges as the antagonist aiming to thwart their efforts to collect treasure. In its use of the apocalyptic flood as a threat, Forbidden Island perpetuates what Simon Estok calls 'ecophobia' (2018). Estok defines ecophobia as a uniquely human psychological condition that prompts antipathy toward nature, suggesting it has derived from modernity's irrational fear of nature and has been perpetuated in pervasive literary and media representations (2018: 1). Ecophobia creates an antagonism between humans and their environments, which is gamified in Forbidden Island in which nature is explicitly the players' opponent. The 'waters rise' cards, which are drawn periodically prompting calamity for the players, offer no explanation for the flooding beyond the inscrutable machinations of an inhospitable environment. Estok suggests that the ecophobic condition has also greatly serviced growth economies and ideological interests, underwriting the extraction and destruction that has fed climate change and mass extinction. This extractive logic is built into Forbidden Island, too, since the island is only valuable for the treasures it holds. Players are not incentivised to save the environment they traverse beyond shoring up those tiles they need to access the treasures and then escape. Game hacks discussed included changing the winning conditions from extracting treasures to saving the island by mitigating the effects of rising waters. Participants discussed the addition of cards that would allow players to work with the environment rather than against it.

MONOPOLY
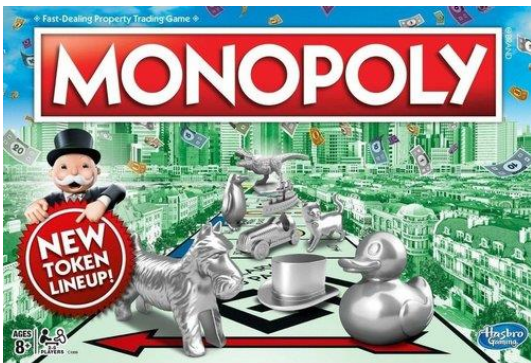
Monopoly. **Elizabeth J. Magie and Charles Darrow. Hasbro, 1935.**

2-8 PLAYERS | 60-180 MINS | AGE 8+

Monopoly is a game that sees players take the role of land owners who buy and develop land, growing their property portfolios and financially ruining their rivals in an often bitter battle of financial domination. Its rules are fairly simple, seeing players take turns rolling two dice, moving their playing pieces around the board (variously representations of international cities) and electing where to invest their funds to best extract money from their opponents.

Monopoly, on the surface at least, is not ostensibly 'about' the environment. It joins this ludography as a popular example of a group of games which place their focus elsewhere while being absolutely implicated by environmental concerns. *Monopoly* is about building, about national infrastructures (rail, energy), about money, and about governments (taxes for example). Where, players might ask, do the building materials come from? What is the impact of building so rapidly? What fuels the various modes of transport (which include cars, boats, and, in later editions planes)? Who is staying in all those hotels? And just how many towels are they using? In being about these things, and yet not raising these questions, the game is an example of what Patricia Yaeger identifies as the 'energy unconscious' (2011: 306) and this awareness (or lack of awareness) makes games which may not explicitly address the climate crisis or representations of nature equally important in terms of the games that participants might elect to play. Other examples of games in this mode include *Ticket to Ride* (Days of Wonder, 2004), *Tokyo Highway* (itten 2016). In such games the consumption of energy is implicit in the expanding of built infrastructure that shape the games' lusory goals while being largely, if not entirely, absent from the constitutive and operational rules.

ORCHARD

Orchard. **Anneliese Farkaschovsky. Art by Walter Matheis. HABA, 1986.**

2-8 PLAYERS | 10 MINUTES | AGE 3-6

Anneliese Farkaschovsky's *Orchard* is a collaborative game aimed at players aged between 3 and 6. As its name suggests, it is a game about fruit picking. The rule book tells us: 'The four fruit-trees are full of fruit. The apples, pears, cherries and plums are ripe and have to be picked quickly, because the crafty raven is eager to pinch some tidbits.' The game is nicely produced, with no plastic pieces, and comes from a company with a clearly stated environmental policy. This states that the company have been producing wooden toys with a PEFC seal since 2010, using beech and birch wood from sustainable forests. They also claim to support the

preservation of an ecological balance of forests and aim to make a significant and lasting contribution to improving forest use and maintenance.

In keeping with the target audience, gameplay is very straightforward. Each turn players roll a die on which there are four coloured circles (each of which corresponds to one of the four fruits on the board), a raven, and a basket. When players roll a circle they take a fruit of the same colour from the board and place it into their baskets. When the basket is rolled players select any two fruit. This is the only decision players (who are playing properly) make during the game. Players will likely soon discover that this one choice comes with an optimal response: select the fruit of which the largest number remain in play. Should players roll the raven, the game's antagonist, they place one of nine raven tiles on the board. If all nine tiles are placed, completing the picture of the raven, the game ends. While requiring little strategic thinking, *Orchard* provides young children with an opportunity to learn turn-taking, counting and colour recognition, to develop their fine motor skills, and to practice, in a non-competitive space, winning and losing.

Orchard models the notion that the longer fruit is left on trees the more likely it is to be eaten by birds. Harvesting fruit, therefore, becomes a race against time. Unsurprisingly for the target age group, no attention is given to the specific ecologies of orchards. For example, the likelihood of four different species of tree all bearing fruit simultaneously is not part of the game, nor is there any reference to threats to orchards, or the importance of suitable cultivars to ensure pollination. Significantly, the system embedded in the game models a conflict between humans (who seek to maximise their harvest) and the non-human world which threatens this aim. This threat to fruit production (or to human desire) is figured as a carrion bird (one associated with death and destruction) and the victory of the non-human over the human is tied to chance. It is notable that while the human society modelled by the game is one of cooperation and shared labour, this cooperation does not extend to the non-human in that the player-harvesters are unable to share any fruit while the raven, it appears, would be satisfied with just a little. For details on how the young people at St Peter's RC High School played and hacked *Orchard* during our project, see: Games Imagining the Future project update. Many of these hacks emphasized the economic dimension of fruit harvesting, instituting costs for the buying and selling of fruit, with players discussing the unfairness of capitalist food production. Players also suggested that the raven, Theo, was being unfairly maligned and that the players' aim to harvest all the fruit would likely lead to him having nothing.

PANDEMIC: RISING TIDE

Pandemic: Rising Tide. **Jeroen Doumen and Matt Leacock. Art by Jeroen Doumen, Atha Kanaani, Matt Leacock. Z-Man Games**, 2017.

2-5 PLAYERS | 45 MINUTES | AGE 8+

Rising tide is a collaborative game where players must work together to build four hydraulic structures, to prevent the North Sea flooding low lying areas in the Netherlands. The game is based on true historical events reflecting the processes the Dutch went through to improve their flood prevention infrastructure at the turn of the industrial age. Game play involves players building dikes, pumping stations, ports and hydraulic systems to limit the areas covered by water. Players must collect and trade in corresponding colour cards to build the hydraulic systems; however once built, they have benefits for that region. If a 'Storm!' card is pulled the sea floods the land, and whichever areas aren't protected by dikes will be flooded with water cubes. The sea level also rises which will cause the succeeding floods to be more severe. Players must work to limit the amount of water cubes in play as surpassing 36 cubes counts as an immediate failure. In its use of the natural environment of an antagonist, Rising Tide echoes *Forbidden Island* and evokes an ecophobic relationship between human players and the environment simulated by the game system.

The game simulates a real world, historical situation, making building dikes an easy short term method of preventing flooding whereas more cards and actions are required to build a hydraulic structure. This implies that building a hydraulic structure might be more costly and require more resources but throughout the game these structures are favoured over the older methods such as dikes, as the dikes fail more often when the sea level rises rapidly. Although the game engages players with a historical industrial-environmental situation, it could prompt discussion of the ways in which the climate emergency will make urgent the need for coastal flood defences across the globe.

The game already supplies various methods of play to adapt player difficulty. The number of 'Storm!' cards that are placed in the deck can adjust the frequency a flood occurs. Beginners are recommended to use 6 cards, the amount increasing dependent on the difficulty level required. There is also a version where a population can be added to the areas. When playing this version, the objective can change from just building the structures to other specific requirements. In addition to the water cube limit there is an added element in which players will automatically lose if, as a team, they've lost 5 of the population cubes to the floods.

In terms of hacking the game to be easier or harder, the included variations already do this very well. Turning the game competitive, by each player having an area they need to protect could be one hack. However, this encourages flooding of other areas rather than the protection of the environment.

PARKS
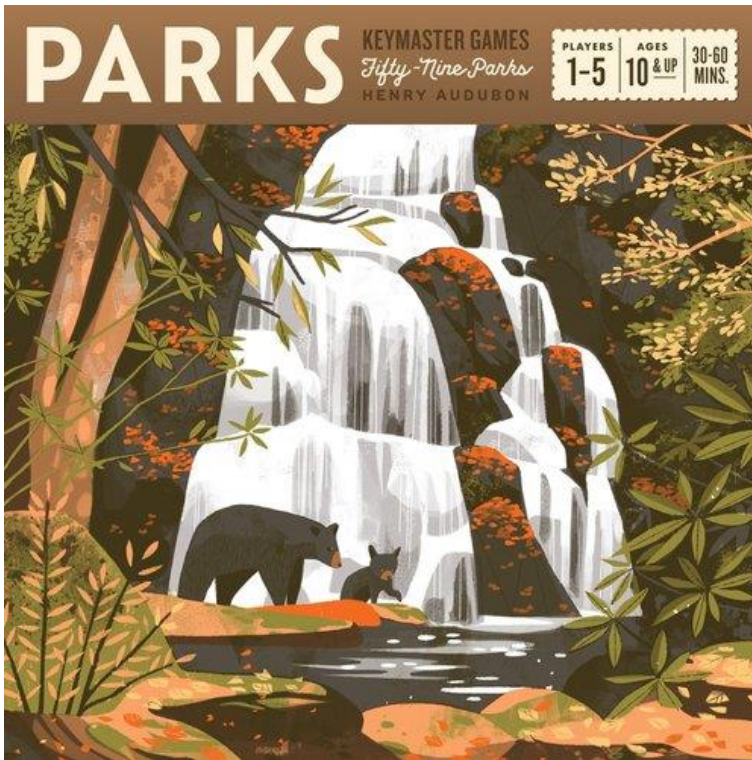
Parks. Henry Aubudon. Art by Fifty-Nine Parks Print Series. **Keymaster Games**, 2021.

1-5 PLAYERS | 30-60 MINUTES | AGE 10+

Parks is a resource management and travel board game where players take on the role of hikers trekking trails in North American national parks throughout four seasons of the year. The game's objective is to score as many victory points as possible, which are earned by visiting national parks, taking photographs along the way, and completing secret personal bonus objectives. Like *Rustling Leaves* and *Bosk*, which are also discussed here, the gameplay of *Parks* changes with each season of the year. Throughout the game, four seasons comprise each round, and each season's weather will define the trail that the players trek. The resource management elements of *Parks* centre on the players' hiking equipment, which includes materials for a campfire and a water canteen. Equipment can also be bought that provides the player unique bonuses and aid them through their trails. For example, a water bottle lets the player refill their canteen at the trailhead, while a compass reduces the cost of resources to visit a park.

Parks' corresponding narrative drive and mechanics of movements through trails highlight its celebratory imagining of national parks, pushing the player to 'get out there' and witness as much as possible. Its story and playstyle are reminiscent of *Tokaido* (2012), a board game where each player travels the 'East Sea Road' in Japan and, on the way, tastes food, collects items, discovers vistas, and visits temples. Unlike some other nature-inspired board games, resource management and competition stem from human-centred equipment and behaviours rather than the national parks being implicated in such endeavours. With competition and resource management being human-centred, hacking a littering mechanism into the game would be an astute way of exploring human-environment relationships. In such a hack, victory points could be earned for each piece of litter picked up while visiting each national park. Every year, visitors to US national parks generate nearly 100 million pounds of rubbish (Pierno 2017). In recent decades, visitation to national parks has increased rapidly and with it, so has the magnitude of littering in these protected areas (Brown, Ham & Hughes 2010). Although a littering mechanic might appear at odds with *Parks*' pristine aesthetic, it would pertinently represent how empty packets of crisps or plastic water bottles pollute national parks.

But as much as the choice *Parks* makes to not implicate the natural environment in the resource collection mechanic of the game helps to highlight the dangers of extractive logics, it also supports the

ideology summed up by the phrase "leave nothing but footprints, take nothing but pictures". While this kind of respect for the environment can be useful from a conservation standpoint, the US national parks have come into conflict with the indigenous peoples which still live on or near the environments that the parks are attempting to protect, as it assumes that all interaction with natural spaces by humans is inherently destructive. One historical example of this conflict is when the Havasupai people were prevented from gathering Pinion nuts and hunting deer in the land near the Grand Canyon National Park's rim, out of fear that they would disrupt the environment that they had been living in for millennia (Hirst 2007).

POWER FAILURE
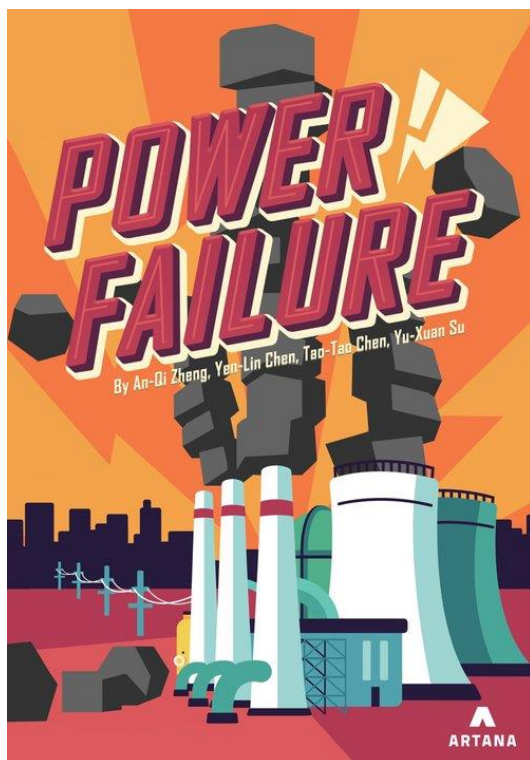
Power Failure. **Tao-Tao Chen, Yen-Lin Chen, Yu-Xuan Su and An-Qi Zheng. Art by Sy Li, Masha Tace, Will Meadows and Sarah Lafser. Artana, 2021.**

2-4 PLAYERS | 45 MINUTES | AGE 14+

Power Failure is a card and dexterity game where players try to collect city cards which account for points at the end of the game. The game involves building power stations, which come with varying levels of risk when activated, to try and generate enough power to win a city card. When building and activating power stations players must add wooden blocks onto the carbon tower, the success of these additions dictates the success of the player's turn. The more unsustainable the action, the more blocks must be added to the tower. For example, when activating a coal power station, 3 blocks must be added, whilst a renewable power source automatically accumulates energy without the need to add any blocks to the tower.

Although the game uses figures likely to be realistic to current energy production, this encourages the building of nuclear, gas and coal power stations over greener energy sources. The renewable power stations don't require any activation and come with less risk. However, with the amount of green energy produced usually relying on which card is dealt for that turn, sometimes the green power stations can produce zero energy. The game tries to combat this failing of renewable energy by making players add more carbon blocks to the tower when activating fossil fuel power stations. However, there are event cards which can allow the player to escape this risk.

Through its mechanics, the game communicates the carbon cost of energy generation, prompting play decisions about balancing energy production with emissions. The renewable energy sources in the game are represented as zero risk, suggesting that, should such energy sources be able to compete with fossil fuels in terms of production, they would solve the current problem of energy production leading to carbon emissions. However, as Mike Berners-Lee points out, the past 150 years of energy history tells us that the arrival of new sources have dented but not stopped the growth of other energy sources. In other words, energy efficiencies often produce concomitant energy demands and until

energy consumption declines overall, there is no way renewables can replace fossil fuels (Berners-Lee 2019: 81-2).

There are several hacks which could make the game engage players in more complex thinking around energy production, efficiency and consumption, such as a hack that asks players to work collaboratively and exchange cards to produce the most efficient, high output system. Several of the coal, gas and nuclear cards could simply be taken out of the deck to encourage players to build greener energy supplies. Alternatively, the power outage for renewable cards could be increased whilst giving a larger forfeit to those who are using finite resources. Such an addition might help simulate the economic policies that will have to go hand-in-hand with transitions to greener energy, as explored in Kim Stanley Robinson's novel *The Ministry of the Future* (2020), which advocates world banks issuing carbon draw-down currencies and carbon taxes to encourage a rapid shift away from fossil fuel extraction and burning.

PHOTOSYNTHESIS
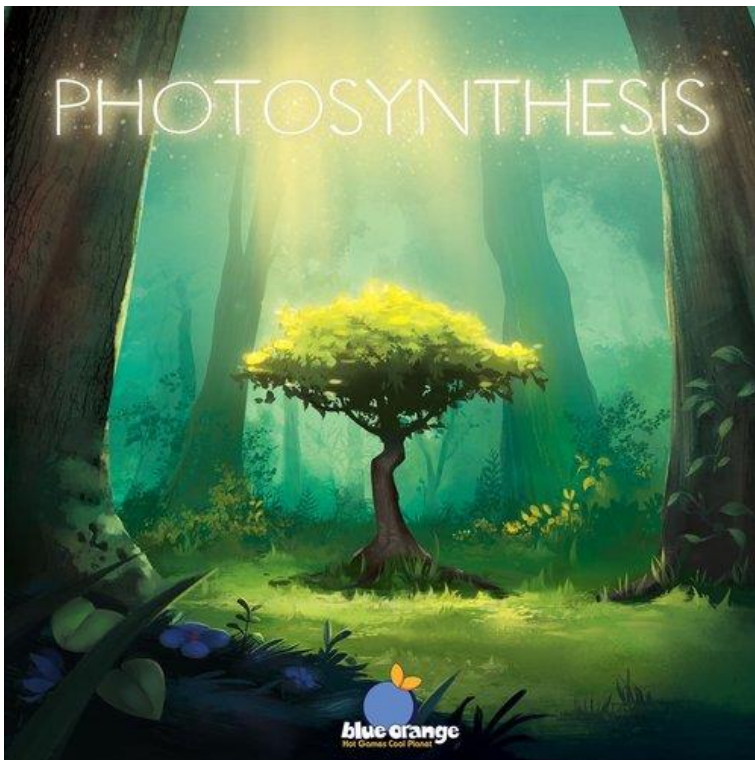
Photosynthesis. 2017. Hjalmar Hach. Art by Sabrina Miramon. Blue Orange, 2017.
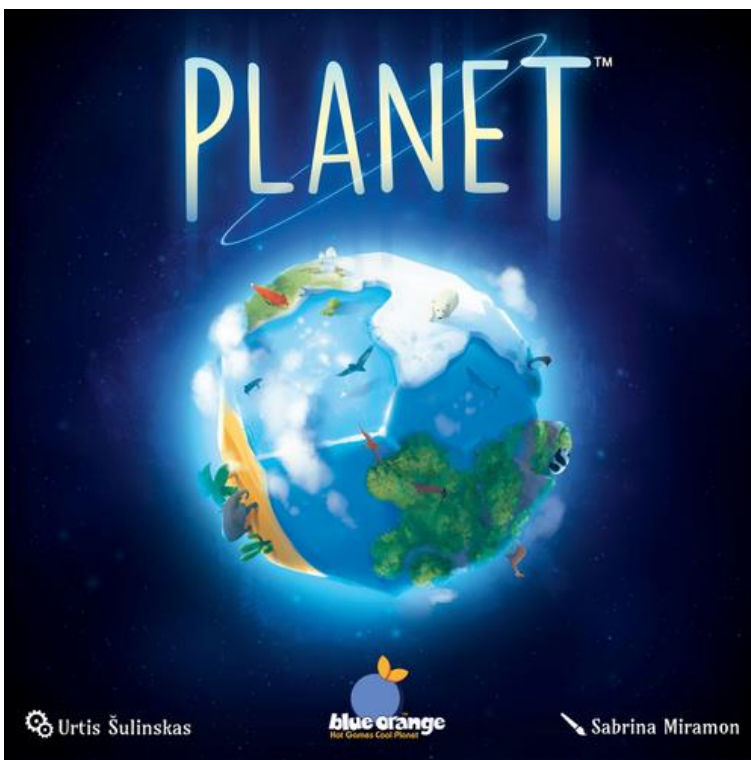
2-4 PLAYERS | 30-60 MINUTES | AGE 10+

Photosynthesis is a game where players take on the role of a species of tree to compete for space and sunlight in a forest. The forest is represented by a hexagonal board on which are uniform circles for players to place individual trees. The sun moves around the board, delivering 'light points' to players depending on their tree's relative position and life stage, while shaded trees will receive no points. More points are given to trees at the centre of the board and trees at later stages of their lifecycle. These points then act as a currency to be exchanged for seeds to place on the board or grow seedlings into saplings, then saplings into larger trees. Players must strategically position and grow their trees to effectively capture light points while denying light points to other players. The endgame of *Photosynthesis* involves a harvesting mechanic where players will 'end the life-cycle' of large trees for points, with the player with the most points winning the game.

Chloé Germaine (forthcoming) proposes that the rules of *Photosynthesis* are 'mismatched' to its framework, aesthetics, and imaginings, drawing similarities between the board game and war games. She writes that the mechanics of area control, expansion, resource taking and collection, 'buying', and upgrading all mirror typical wargame mechanics and positions trees as a passive resource for human management and consumption. Because *Photosynthesis* interprets forests as arenas of competition, Germaine contends that the game upholds a 'survival of the fittest' doctrine. Instead, she cites Suzanne

Simard, who describes an 'extraordinary generosity' of woodlands between each collaborator in its ecology (Simard 2021: 11). In recent nature writing these sentiments have also been expressed. Commenting on Emmanuel Coccia's plant philosophy, Wohlleben says: '[h]e thinks it is a great shame that for the past one hundred years we've seen nature as a huge war zone [...] On the contrary, it is characterised by solidarity' (2021: 110). A shift in the rules that enables players to collaborate to produce this kind of natural solidarity, rather than having to compete, would relieve some of the tensions that Germaine describes between mechanics and aesthetics of *Photosynthesis*. For example, when the player ends the life-cycle of a tree, the tree will enter a 'decaying' stage where its body will nourish the soil with nutrients and propagate the growth of fungi. In this stage, each adjacent seed or tree to the decaying tree will progress through a life stage, and points will be earned for each tree nourished this way. However, Photosynthesis' design does not only operate through warlike mechanics as each player must propagate and nourish their seeds and saplings with light which allows feelings of affection and care to arise during gameplay. A final remark must be made about *Photosynthesis*'s beautiful artstyle and game pieces that constantly remind players of forests' beauty throughout the earth.

PLANET

Planet. Urtis Šulinskas. Art by Sabrina Miramon. Blue Orange, 2018.

2-4 PLAYERS | 30- 45 MINUTES | AGE 8+

Planet is a tactile game in which players build their own individual world by selecting vibrantly coloured tiles containing different biomes: ocean, desert, mountain ranges, forest and glaciers. Each player also has an individual objective card and is aiming to collect as many of their specific biome tiles as possible in order to score extra points at the end of the game. Animal cards are also obtainable throughout the game, and the player must have the largest biome relevant to that animal to win the card. At the end of the game, the winner is the player who has accumulated the most points, through their personal objective and through their quantity of animal cards. The card layout is reasonably long so requires around a one-meter length table or floor space.

The game is competitive and allows for the players to deny others tiles of certain biomes. However, this directly competitive element is usually overlooked by the personal objective taking top priority for the player as they focus on building their own planet. Tactics are also made harder by the design of the game. The maximum number of players is 4 and, on each turn, there are 5 tiles to choose from. Therefore, the last player to pick still has a choice of tile. The game isn't focussed on destroying each other's chances, rather on individually creating a habitable planet that can gain the most points.

As there are two elements of focus: the objective card and animal cards, this could lead players to stray away from creating a diverse planet, to focus on solely collecting a specific biome. Also, as there are many animal cards which aren't played in each game this could occasionally lead to a lack of diversity depending on how the cards have been drawn.

Once an animal card has been won, the player has no more responsibility to maintain that card. The game focuses on creating an ideal planet which doesn't encounter any hostilities: all outcomes are based on the players' choices and are suggested to result in stable habitats. To create a more realistic representation of how a planet operates, a die which contains natural disasters or unexpected events which compromise a player's ecosystem could be rolled at intervals throughout the game, disrupting any tactics a player has or to encourage greater diversity on their planet. Despite its limitations, *Planet* encourages the player to create their own diverse planet that is capable of supporting life.

RENATURE
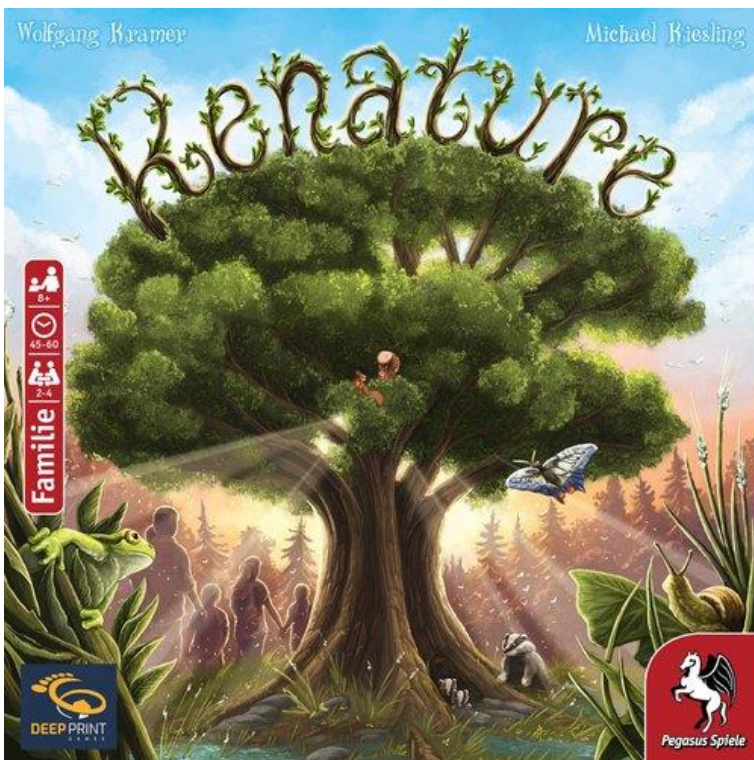
Renature. **Michael Kiesling and Wolfgang Kramer. Art by Dennis Lohausen. Deep Print Games, 2020.**

2-4 PLAYERS | 45-60 MINUTES | AGE 8+

Renature is a competitive board game where players plant trees in a national park to compete for points. There are various methods for collecting points: by planting trees which are an equal or larger size than an opponent's, by collecting cloud actions throughout the game and by obtaining the highest number of tree points within a blocked off area.

Animal dominos are required to be next to an area of land in order to plant a tree however, they aren't really used for gaining points. The dominos are also used for blocking off areas of land, where the person with the highest number of trees gains further points for that area. Laying the dominos on each turn can sometimes make the game limiting, as an area needs to be completely concealed to gain points from it. With many ways for players to gain points, differing objectives sometimes caused areas to remain open, meaning there are points going unclaimed. Whilst trying to populate the land with trees, players are also trying to prevent others from planting the biggest tree. The complexity could possibly be a hinderance, as sometimes not all strategies can be used however, this reflects the complexities of a functioning ecosystem in a national park.

Hacking the game could be focussed around increasing diversity. The dominos represent animals usually found in a typically European national park, so choosing a different ecosystem could be a way of expanding knowledge of different areas. Players could also gain points for the variety of dominos they use and for the variety of trees they plant. Another method to increase diversity would be to play

collaboratively. By being transparent with the dominos players could work out the best strategy to populate as many of the areas of land as possible, rather than competing for the space.

RUSTLING LEAVES
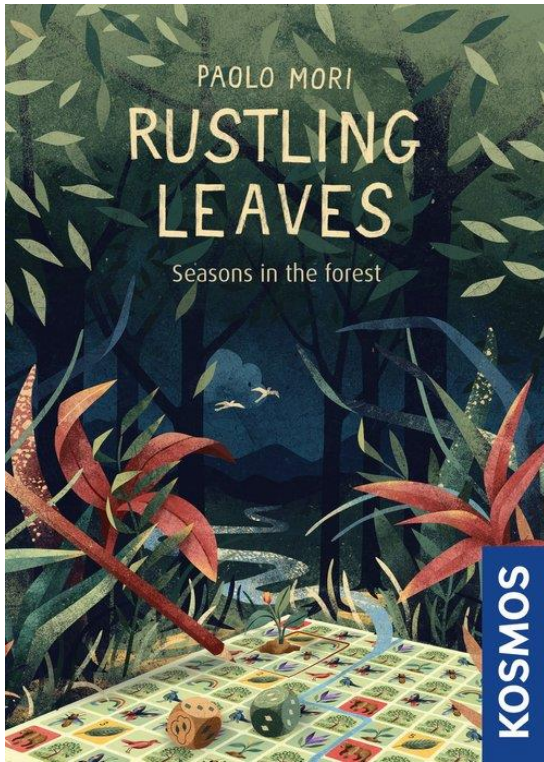
***Rustling Leaves*. Paolo Mori. Art by Elli Jäger. Kosmos, 2020.**

2-6 Players | 20 minutes | Age 8+

Rustling Leaves is a roll-and-write game set in a forest habitat with varying rules as the seasons – spring, summer, autumn, and winter – change. Each player will get a sheet of paper upon which a grid represents the forest habitat, with each square featuring a symbol of an inhabitant of the forest, including fungi, plants and animals. Players will roll two dice and enclose a space of the grid relating to the respective numbers rolled. For example, if two and three are rolled on the dice, players must enclose a 2x3 or 3x2 space of the habitat. Points are scored by crossing off a symbol in the enclosure, with each symbol having a different way of scoring. For instance, during the spring rules, will score five points per pair in the same enclosure, while twelve points are scored for every four pinecones during the autumn rules. The game is reminiscent of using a quadrat during biology lessons to isolate an area of a particular biome and then measure how many organisms are present as a small-scale representation of the population of that biome. Though more exciting than a school field, *Rustling Leaves* features seeds, plants, bees, butterflies, songbirds, bears, foxes, squirrels, moose, berries, mushrooms, and rainbows.

The principal tension between concepts of ecology and *Rustling Leaves* is that the point-scoring mechanic sometimes does not relate to the habitats the game represents. While some creatures and plants have mechanics that reflect their actual counterparts, such as squirrels scoring points by being enclosed with acorns, many inhabitants score points by being enclosed. Further enclosing certain poisonous mushrooms causes players to lose points despite being vital co-constituents of forested environments. As such, the entangled relationship between each inhabitant of the habitat is not explored in gameplay. Unlike many other nature-inspired board games, such as *Photosynthesis* or *Ecosystem*, players only observe the habitat in which the game is set rather than actively shaping and controlling it. Although players cordon off areas of the habitat, this appears not to affect said habitat, only producing significance through point scoring. It feels like playing a game *with* nature rather than transforming nature into a tool, resource, or competitor in a game.

SCYTHE

Scythe. **Jamey Stegmaier. Art by Jakub Rozalski. Stonemaier Games, 2016.**

1-5 PLAYERS | 115 MINUTES | AGE 14+

Jamie Stegmaier's *Scythe* is an engine-building game in which players take control of nations struggling to survive in 1920s 'Europa', a place riven by unrest caused by the Great War. The city-state known simply as "The Factory", whose territory occupies the centre of the board, has fueled the war with the production of heavily armored mechs. The game opens when the Factory has closed its doors, drawing the attention of nearby armies keen to get hold of technology to improve their lot.

Scythe is an engine-building game set in an alternate-history 1920s Europe. Each player represents a character from one of five factions of Europe who are attempting to earn their fortune and claim their faction's stake in the land around the Factory. Players conquer territory, enlist new recruits, reap resources, gain villagers, build structures, and activate mechs to earn victory points and end the game. *Scythe* favours gameplay skill over luck. Other than each player's individual hidden objective card, the only elements of random variability are encounter cards that players will draw as they interact with newly explored territories. Combat is also driven by player choice, not luck. *Scythe* uses a streamlined action-selection mechanism (no rounds or phases) to keep gameplay moving at a brisk pace and reduce downtime between turns. While there is plenty of direct conflict for players who seek it, there is no player elimination. It has been described as a hybrid game, combining elements of the Ameritrash genre with eurogame resource management and strategy.

It is theme rather than the mechanics that earn *Scythe* its place in this ludography. Set in an alternate-history 1920s Eastern Europe, it is a game of farming and war in which powerful nation states vye for land and resources. While the game's setting is described as alternate-history, *Scythe* might be equally well described exploring a speculative future characterised by aggressive competition for resources. There are many possible examples of games that imagine pessimistic futures brought on by the climate catastrophe. Other examples include *Frostpunk: The Board Game* (Glass Cannon Unplugged, 2022), a game set in the aftermath of an ice storm of apocalyptic proportions and Jeff and Carla Horger's *Mad Max* style racing game *Apocalypse Road* (GMT, 2020) in which the absence of story leaves players space to ask themselves just why it might be that they find themselves racing cars at the end of the world? Rolling coal springs to mind.

The potential value of such games is in the way that they allow plates to explore potential futures and the possibility of conflict for limited resources shaping human social interactions and politics. Similar climate imaginaries should be expected to emerge in game-based discussions of the climate crisis. Indeed in our hacking workshops with young people games such as *Catan* and *Forbidden Island* have rapidly been reskinned as nightmarish games of collective disaster in exuberant displays of what has been described as 'dark play', a mode of play that exploits tension between order and chaos, evokes subversive or otherwise deviant themes, and deceives players such that the boundary between play and not play becomes porous (Schecher 2002; Linderoth and Mortensen 2015: 5; Germaine Buckley 2020: 363). Such dark play is expressed in both the narrative and mechanics of Scythe, with players

able to choose encounter options that sabotage citizens' recovery efforts through theft or violent intimidation, though such choices always come with a cost to popularity, which is the games' victory points multiplier stat. Unpopular factions will find it hard to win victory at the close of gameplay.

SEQUOIA
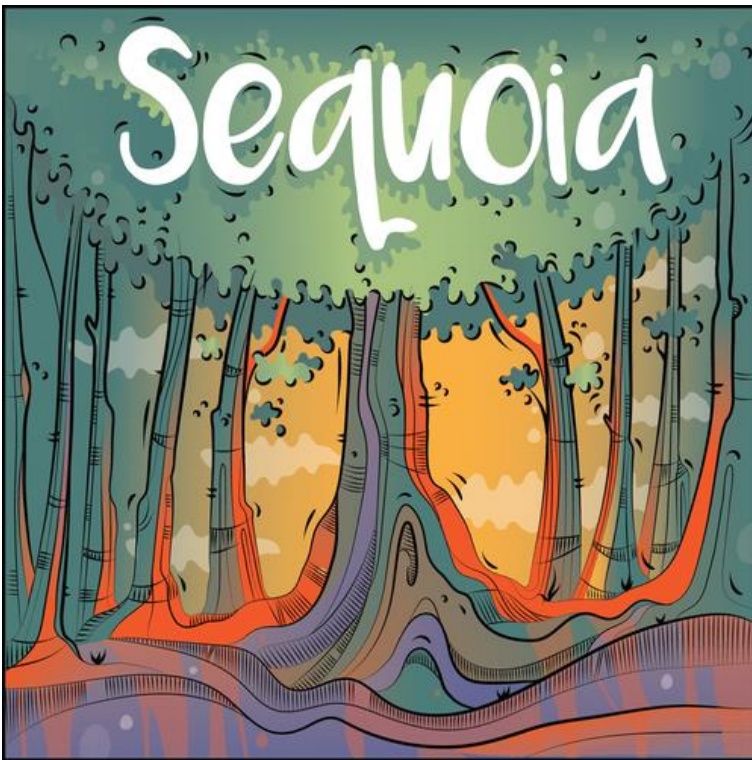
Sequoia. Chad DeShon. Art by Anca Gavril and Daniel Profiri.
BoardGameTables.com, 2020.

2-5 Players | 10 minutes | Age 6+
Sequoia is a dice game in which the objective is to vie for dominance and score points by having the tallest (or second tallest) tree in each of the game's eleven different forests. Each player is given five dice and twenty tokens representing cross-sections of a sequoia tree's trunk. Forests are represented by tiles labelled two through to twelve and are placed together on a surface in front of the players, and then each tile will be assigned a first and second place marker that signifies the points players will win should they grow the tallest tree in that forest. Gameplay takes place over ten turns, and with each turn, the player will get to grow two trees in any of the forests. To grow their trees, players will secretly roll their five dice at the start of each turn and make two pairs, leaving one dice aside. Each player will then place a tree token on the numbered forest tile that matches each dice pair's number. With each token placed on the forest tile, the player's tree with 'grow' and the player with the tallest stack of tokens in each of the forests at the end of the game will win the points associated with that forest. The player with the second tallest stack of tokens will win a smaller number of points.

Sequoia trees are famed for their great stature as they tower above all else in their forests, with some of the tallest trees given authoritative names such as 'General Sherman' and 'The President'. A board game centred upon growing the tallest tree befits the perceptions of these gigantic trees. However, as the player is often subject to the luck of the dice, *Sequoia* feels more akin to the board games *Ludo* or *Frustration* with only its height mechanic and art styles representing sequoia trees. *Sequoia* also divorces players from some of the intricacies of balance that sequoia tree forests rely upon by centring an over-arching goal of points accumulation through the domination of forests by individual trees. Besides their height, sequoia trees are unique in that they have, arguably, adapted to the annual forest fires of western North America and evolved fire-resistant bark. These wildfires burn away the competing forest vegetation while bringing hot air high up to their canopies which dries and opens their cones and releases seeds to postfire seedbeds now rich with the nutrients. *Sequoia*'s mechanics are relatively simple, and hacking the game to include a wildfire mechanic where fires must be kept

stable throughout the game to proliferate seeds and cultivate the forest, would add another layer to this game that continues to celebrate the exceptionality of the sequoia tree.

THEY ARE HOLLOWS OF DESOLATION

They are Hollows of Desolation. Gordie Murphy. Art by Gordie Murphy. Itch.io, 2021

1 - 5 players plus a Game Master | 2 hours + | Adult

They are Hollows of Desolation is an independent tabletop roleplaying game designed by Gordie Murphy using the simple d-6 *Trophy* storytelling roleplaying system developed by Jesse Ross for the Gauntlet. During *Hollows*, players invent and explore a collapsing ecosystem to discover and bring back treasure contained therein. A ravaged and animated landscape emerges in play through the interactions of the GM, the players, and the imagined world itself, which is not pre-designed but invented and described through the course of play. Magic is very important in the game and seems to function as a metaphor for the 'magical' thinking of extractive capitalism. If player characters use magic to progress through the landscape, which often they must, they accelerate the collapse of the hollow and dangerous 'dredge' effects manifest, which might include the appearance of monstrous creatures or toxic extrusions from the land itself. Such 'dredge' effects emphasize the interdependence of human and more-than-human worlds, as human magic draws on and affects the damaged landscape, making the journey ever more perilous and the need to use magic more urgent.

Through collaborative storytelling mechanics, the game presents ecosystems as unstable and on the edge of collapse. This punctures a notion of ecology rooted in cybernetic fantasies of human control. This loss of control is given imaginative force through the dark fantastic aesthetics of the game. Human agency and control is also complicated through the ways in which the game encourages players to animate the environment, ascribing it subjective and agentic properties. This isn't about mapping a dungeon, fighting the bad guys, and escaping with the loot. This is an exchange between the game master and the players but also, once that exchange has begun, the world of the game itself, which is not exteriorized but intimately entangled with the players and their characters. The environment that players build in Hollows builds itself as we describe new encounters, discuss potential dredge effects and consequences of our explorations of the space.

WINGSPAN

Wingspan. Elizabeth Hargrave. Art by Ana Maria Martinez Jaramillo, Natalia Rojas, Greg May, Beth Sobel. Stonemaier Games, 2019.
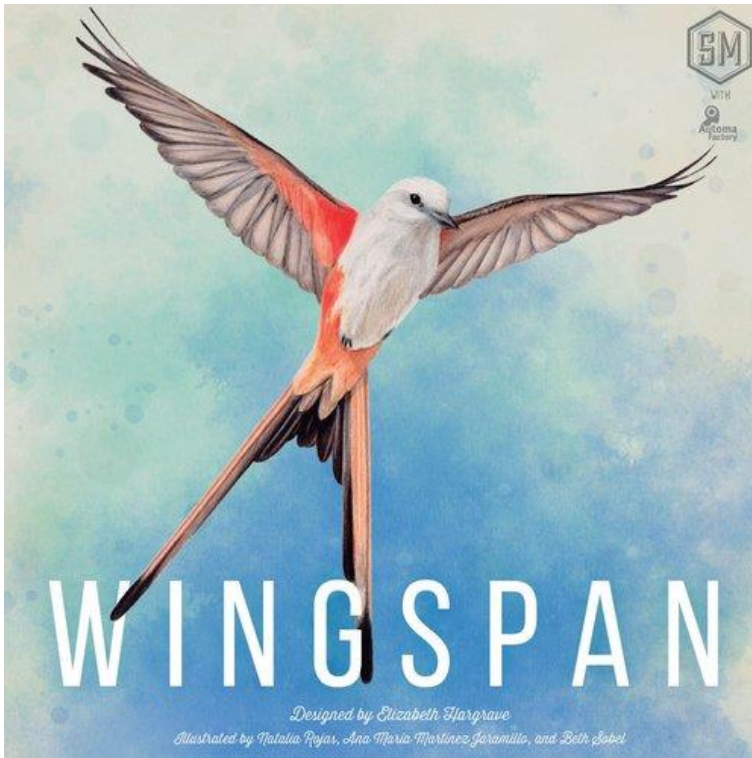
1-5 PLAYERS | 40-70 MINS | AGE 10+

Wingspan is an engine builder game in which players are bird enthusiasts who compete to build the best bird sanctuary within four rounds. Each player has their own personal board made up of three different habitats: forest, fields, and wetlands. These habitats also correspond to three of the four actions players can make on their turn: Gain Food, Lay Eggs, and Draw Bird Cards. By performing the fourth possible action, Play a Bird Card, in any of the three habitats, the player increases the rewards received by taking the corresponding action. For example, a player who plays a bird card in the wetlands is able to draw more bird cards when they decide to take that action. In addition, each bird added to one of three habitats extends the combination of card effects which take place when taking the corresponding action. The card effects can include, for example, drawing more bird cards, caching food, laying more eggs, moving birds between habitats, hunting for smaller birds.

At the beginning of the game players are given a bonus card which includes a personal long-term goal that, given their board meets certain criteria by the end of the game, will award the player with bonus points. As well as these personal long-term goals all players are competing for the end-of-round goals. These are randomly selected at the beginning of the game and can include goals such as total number of birds, eggs on ground nests, or birds in the forest habitat. The player with the most instances of the current goal takes first place and the corresponding number of points. By the end of the game, players will have points spread out all over the board in a variety of areas. Each bird card has specified points listed on them that are awarded at the end if they are populating your sanctuary. Points are also awarded if you have birds that match your bonus card (for example two points per ground nesting birds), and for scoring on the end-of-round goal board, the number of eggs on your birds, number of cached food, and number of tucked birds. For the solitary board gamer, *Wingspan* also offers a single player mode where one player takes on the Automa, a non-human opponent that operates through a special pack of cards included in the standard game. For the human player turns run the same as a multiplayer game, however the Automa has no board, hand of bird cards, nor food tokens. Instead, players turn the shuffled pack of Automa cards and follow the instructions to calculate how the Automa acts each turn.

The game situates the players as bird enthusiasts, 'researchers, bird watchers, ornithologists, and collectors' all of which are groups of people with very different goals in their interactions with birds.

These different goals appear in the bonus cards which are all named after someone who might be interested or interact with birds, but the majority of the embodiment of this role comes from a player's personal narrativizing of their own play experience rather than being embedded in the game's systems. This is a point of tension between the game's theme and mechanics, where the enthusiasm for birds is replaced by a process of evaluating birds for what they can bring to the table (a large number of points, the ability to hold many eggs, or a power that works well in the player's engine). Actual bird enthusiasts may feel unable to play a bird they like or think would help make a "good" sanctuary as doing so may hamper their chances of winning. During play there is also little reason to focus on the bird sanctuaries the other players are building as there are very few instances where players can interact. The players may be playing bird enthusiasts but the only birds players are incentivised to engage with are their own.

There are 170 bird cards in the standard game and each illustration is beautiful to look at and reminiscent of the drawn examples of birds in a guidebook. Each bird card also includes a small fact about the bird shown as well as where they can be found in the world and their common and Latin names. These cards could easily be taken from the game and incorporated into a different game, for example, an improvised game of bird top trumps. In the standard game the birds are heavily North American focused with only 18 birds in the deck being found in Europe. There are also expansions which include European birds and Oceania birds which rebalances this particular bias. However, at the price point of £25 per expansion that makes a full copy of Wingspan cost just over £90.

This game is fertile ground for hacks. Possibilities include creating a cooperative mode of play by asking players to collaborate on one board or amending the mechanics to award points to players who build a sustainable ecosystem. Rule-based hacks might also work towards simulating a living habitat. There are rules which reduce the amount of turns a player gets per round (in round 1 players have 8 turns per round which is reduced to 5 turns in the final round). There are four rounds so this could be easily reskinned to represent the seasons. The habitats in the game are affected by climate change, deforestation, floods, wildfires, local conservation efforts, governmental policy, and so on. A new deck of cards could therefore be created to explore anthropogenic habitat effects which alter gameplay and then drawn on a per-round or even per-turn basis. Throughout the game players are discarding bird cards. What happens to these unwanted birds? Maybe they will start their own bird-owned *coop*erative sanctuary. The YouTube channel, *Dragon's Tomb*, offers a fun set of alternate rules that remakes the game into a transmogrifying engine during which birds compete to become human (see video below). Such an irreverent hack punctures the mainstream conception of nature perpetuated by the game, which presents bird sanctuaries as spaces for aesthetic pleasure, and represents birds instead as uncanny, wild, even dangerous creatures. These alternative conceptions of 'nature' are useful for helping us question didactic moral norms implicit in mainstream environmentalism and popular notions of 'nature'. As Nicole Seymour (2018: 77) suggests, delight, irreverence, perversity, and other 'bad' affects might be valuable in cultivating different ecological attitudes that recognise the intrinsic value of animals, rather than evaluating them based on human tastes and needs.

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