Bringing conservation onto the STEM agenda

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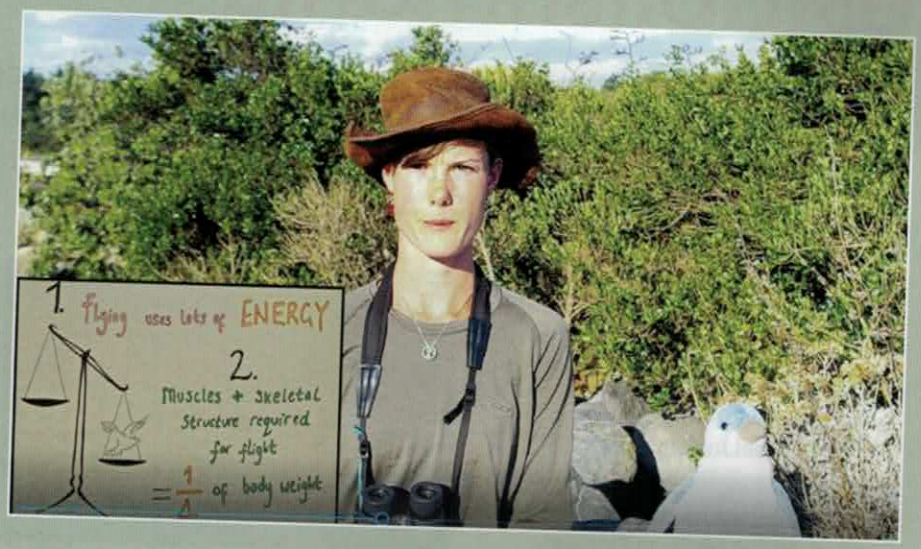
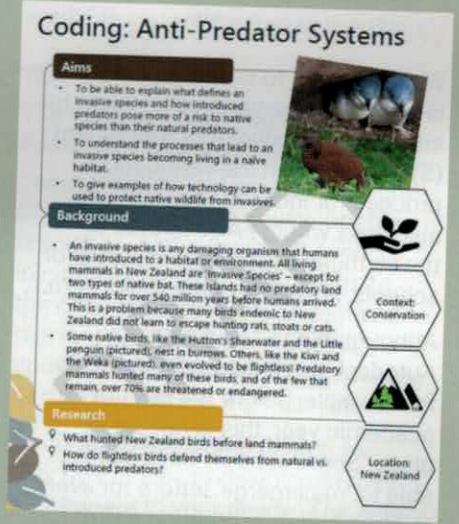
Conservation is rapidly adopting and exploiting technology to improve research studies by reducing costs, improving safety and reducing invasive techniques. In this field there is a whole raft of design opportunities with a range of fascinating contexts. These contexts come from around the globe – and now beyond as space debris creates new environmental challenges. Science investigations linked to conservation issues are common right through primary and secondary science so to complement these and set design challenges the Global STEM Award Conservation Pathway linked with like-minded organisations including The Yorkshire Wildlife Trust in the UK, high country nature reserve Puhi Peaks Station in New Zealand and wildlife telemetry experts Wildlife Computers in the USA.

The two projects discussed here are from the Global STEM Award Conservation Pathway. The first focuses on inventing systems for reducing the impact of invasive mammalian predators on flightless or burrowing birds native to island nations, and the second challenges design engineers to build wildlife crossings to mitigate habitat fragmentation.





Coding: Anti-Predator Systems

Example location: Kaikōura, New Zealand – Key Stage 3/4

Island nations such as New Zealand and Madagascar are home to many unique flightless and burrowing bird species. Without a need to fly to escape predators, flightless birds survived for millennia by hiding underground or freezing on the spot if they were at risk from aerial attack by larger birds – their only nemesis. The little blue penguin is the smallest species of penguin at 30cm high. They avoid predators by coming ashore at night and by nesting under rocks, flax bushes or in sandy burrows. From the late 1200s onwards, human settlers introduced the first land-mammals into New Zealand, some by accident (Polynesian and Norwegian rats) and some on purpose (hedgehogs, stoats, wild pigs, domestic cats and dogs). The evasion tactics previously employed by little blue penguins and other flightless birds, such as the kiwi and the weka, no longer worked against these new mammals that hunted using smell. A small population of little blue penguins, of no more than 10 breeding pairs, continues to coexist with modern-

A pair of little blue penguins makes a nest under a convenient box in Kaikoura, New Zealand. Image taken with permission.
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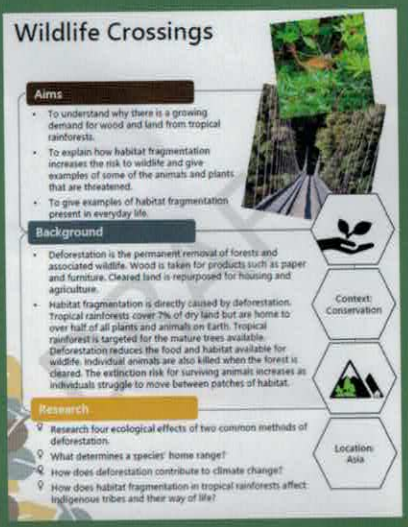
Wildlife Crossings

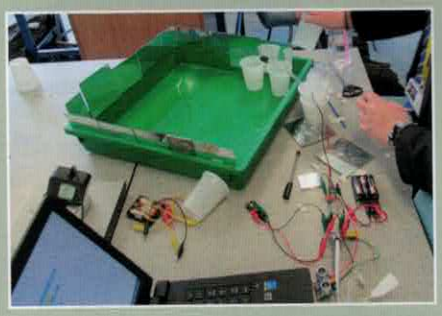
Example location: tropical rainforests in Asia – Key Stage 2



Habitat fragmentation is a serious problem caused by deforestation operations in the tropical rainforests of Southeast Asia. The extinction risk for native animals, such as the orangutan (now restricted to parts of Borneo and Sumatra), increases rapidly as resources such as food, breeding sites and mates collapse into smaller and less accessible patches.

Relevant to almost any development in the UK, wildlife crossings are a new take on the established STEM activity of bridge and/or tunnel building. Many animals native to the UK that travel or migrate overland, including badgers, frogs, and deer, suffer either through being killed on fast roads or prevented from having access to food, water, and other resources. Water voles have severely declined in the UK due to habitat loss. Our native bats rely on roost sites in trees, yet these are often cleared to make way for agriculture and residential homes.

This project encourages students to consider the needs and behaviors of the 'user' and introduces key aspects of conservation research, such as the 'home range'. There is scope to reflect on the drivers behind human-animal relationships, and opportunities to explore ideas around sustainability, including how recycled materials can be used by the every-day consumers and within the construction sector. Focus is provided by exploring 'who makes this happen in real life', from bridge engineering, civil engineers, and architects, to the environmental scientists and ecologists responsible for monitoring the effectiveness of their Wildlife Crossings.



day settlers in the coastal town of Kaikōura, in the South Island of New Zealand. Eggs and penguin chicks fall prey each breeding season to hedgehogs, rodents, and cats. Adult penguins are picked off by uncontrolled dogs.

The challenge: Design a system to protect the nests from these ferocious hunters

A conservation volunteer provides a behind-the-scenes introductory video to set the scene, and hopes to inspire students to think about pursuing a career in wildlife conservation. The anti-predator challenge asks students to look at the impact of invasive species on an indigenous population and come up with a system prototype that will firstly detect a predator, and secondly, deter or stop a predator from approaching the little blue breeding ground.

Students at John Whitgift in North East Lincolnshire responded with a Crumble controlled system triggered by either ultrasonic distance or passive infra-red sensors. Outputs involved buzzers, noisy 'bashers', or pumps mounted on servos to give a spray of water across an area. A follow up online evaluation with our educational resources developer in the field in New Zealand evaluated and discussed the ideas.

In the real world, systems such as these would be required to go through many iterations of the design and develop process, to ensure a high quality of animal welfare. The discussion on 'who makes this happen in real life' included a diverse range of skills from computer scientists, engineers to conservationists and environmental scientists.

It you want to try this project the video is at www.youtube.com/watch?v=HljlHoseIgA