

The door at the entrance of the glow worm caves in Waitomo was once a solid door. As tourist numbers increased, so did the carbon dioxide levels inside the cave (more respiration due to higher numbers of visitors). In 1974, the solid door was replaced with an open grill gateway, with the aim that they could improve the airflow, but the stronger air currents caused the cave to dry out and a lot of the glow worms in the cave died as a result. Because the whole point of the cave was to show tourists the lights of the glowworms, and there were none to be seen, the caves were closed. A solid door was reinstalled and the open grill gateway is now only used if carbon dioxide levels get up too high, or if the weather is quite warm...

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Lighting put in for tourists and brought in by tourists, has impacted quite dramatically on the caves, and the flora and fauna that call it home. Early tourists saw the inside of the caves by using magnesium flares, which burnt with an extremely bright light, and they were able to see the cave, and all its formations really clearly. Unfortunately, the flares had a very big downfall. As they burned, they gave off a lot of black smoke, which stained the speleothems in the Aranui cave (Waitomo) quite badly. When they switched to electric lighting, they encountered a whole new set of problems. Floating around in the atmosphere, there are fungi and algae spores. In a cave, they can settle and if permanent lights are put in a cave, these Spores begin to germinate, growing into what is known as lampenflora. Lampenflora is not visually appealing, and it also begins to attack the surface of the cave decorations, discolouring them, their new colour dependent on the bacteria and fungi associated with the lampenflora. But permanent lighting in caves can also have a positive impact. When tourist companies built paths through the caves, the lights they had built in to light the paths, attracted glowworms to lay eggs where they wouldn't normally lay them. Because of the biophysical environment in a cave, glowworms have adapted to spread their populations very slowly, due to the fact that they usually lay their eggs amidst the lights of other glowworms, and it takes quite a while for a single glowworm to lay eggs beyond that. But the lights that were placed in the cave by the companies attracted glow worms to it, fooling them into thinking it was another population of glow worms, so they began to lay their eggs in those places as well. As a result, they formed 3 or 4 populations of - glowworms, relatively large in size, and quite easily visible to tourists, which is a positive. ..

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SECTION THREE: How These Impacts Are Dealt With **OUTSIDE THE CAVES:**

With erosion, build-up of silt, and sheer carelessness happening above or around the outside of caves, it would seem that there are endless problems, but luckily there are many groups willing to help and constantly checking the human impacts outside the caves. With a bit of care and effort, our caves can be kept clean and the impacts on them can be kept to a minimum. Conservation work can also help combat and repair some of the damage sustained in the past. -

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Some of the groups helping to protect the caves from above ground, include Environment Waikato, Department of Conservation (DOC), Queen Elizabeth II (QEII) Trust, NZ Forest

Restoration, the Waitomo District Council and local tourism operators, who all work very hard to make sure that the karst landscape surrounding them and the caves is properly looked after. To reduce silt build up in caves, and improve the water quality that flows through them, they have fenced off bush areas from grazing, planted many plants along the banks of rivers, and built sediment dams...

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When setting up infrastructure in caves, tourist companies have one goal in mind, develop the tour, but keep impacts on the caves to a minimum...

In the clean-up phase, they also removed a lot of rotten wood, left there by the early owner of the caves, during the time when he had taken tour groups through. The reason for removing the wood was that it was foreign to the cave anyway, and they were trying to restore the cave back to its original state as much as possible. Whilst putting in all of this infrastructure, they had to be careful not to damage the fragile speleothems on the floor of the caves, so they before building the paths, the tourism groups put in blocks and long planks of wood to lift up the path from the floor of the cave, and minimise any trampling of the formations on the ground. They were careful with the materials they used to build the infrastructure throughout the caves, the walkways made of a special concrete formula that ensured it did not leach anything into the surrounding cave atmosphere. Underneath all that 'concrete' they laid out honeycomb grids made of plastic, which duct the water and any excess materials into areas that minimise the impact that they have on the caves. Everything they put into the caves is specifically designed to be able to be dismantled and taken out of the caves, without leaving any trace behind, again, minimising the impact of it for years to come. Some of the walkways are suspended above the ground, to cut down on the amount of material and the impact of said materials on the floor of the cave. They drilled holes and put in bolts that are capable of holding up to 30 tonnes, holding the walkways on strong wires. These walkways are also designed to be completely dismantled if future circumstances require them to be. Less of a task, some parts of caves in Waitomo have simple lanes made of tape, that tourists are asked to stay inside, to keep the effects of the tours small....

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The caves that we have here in New Zealand need to be protected as much as possible, to minimize the human impacts that we put on the caves and their atmosphere. Tourists could perhaps be better educated before going on tours where they are able to reach out and touch fragile artefacts like speleothems. It is important that regular checks are made to monitor humidity levels, carbon dioxide levels etc, so that we can make adjustments if necessary. There are a lot of educated people currently looking after our caving systems, but there's always improvements to be made.

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