Ecological Case Study of Happy Valley
(upper Waimangaroa Valley, Ngakawau District)

Prepared by Daniel Bruce
for NZ Natural Heritage (121.103)
Massey University 2006

(Note: Version 1.1 does not include photos or appendices and is being distributed for comments, corrections and additions from other researchers with knowledge of the Ngakawau area)

Daniel Bruce

04270076

Happy Valley (upper Waimangaroa Valley)
Buller District
NZMS 260 L29 150450
700m

Abstract

This case study is based on field work carried out in the upper Waimangaroa Valley, a pristine monatane wetland affected by high rainfall and strong, often cold winds. The various wetland and hillside communities are underlaid by Brunner coal measures and surrounded by branches of the fault complex responsible for the Southern Alps which has shaped the rocks over millions of years.

Climate, geology and flora combine to create a unique hydrology involving scree slopes, tarns, marshlands and streamlets which feed two streams, one exiting at each end of the valley. The flora are dominated by red tussocklands and manuka-beech scrublands which are interspersed with a plethora of native and many endemic plant species. Fauna consists of threatened species of kiwi and weka and many other native birds, reptiles, and inverterbrates along with exotic amphibians and very few mammals.

It is co-owned by three Crown agencies and subject to a mining proposal by Solid Energy which is staunchly opposed by tangata whenua and conservationists for biodiversity and climate change reasons but vehemently supported by many in the local community for economic reasons. Permission was granted on the proviso that Solid Energy transfer and store a proportion of the wetland and restore it on completion of mining and fund a predator-free area for kiwi and land snails.

Historically part of a thoroughfare and food and water source for Maori and a gold and coal mining area for European settlers, early miners named it Happy Valley. Current usage is minimal except for the presence of a protest camp. Cultural differences between tangata whenua, conservationists and locals in favour of mining derive from strikingly different worldviews and priorities, amplified by the PR work of resource extraction companies for their own benefit.

The valley is a natural refuge and wildlife corridor and the report recommends retention as reserve as even underground mining is not an option for safety reasons and would still cause ecosystemic damage. It points to the inevitable demise of the coal industry and suggests some potentially sustainable forms of economic development for the West Coast. It concludes that co-operation between greens and workers against the despoil-for-profit model and direct public participation in decision-making are essential in the transition to a sustainable economy.

Table of Contents

Introduction to Happy Valley

The upper Waimangaroa Valley (NZMS 260 L29 150450, see Appendix G), also known as Happy Valley (see History) can be found approximately 25km north-east of the Buller town of Westport, forming a small part of the 14,000 hectares of the Paparoa (Denniston) coal measure plateaux. Found in the West Coast region of Te Wai Pounamu, the Paparoa (Denniston) plateaux range between 400m and 1000m above sea level (Norton, 1997). Happy Valley itself is around 700m (NZMS 260).

The valley's altitude places it in the montane category of habitats (Crowe, 2004). Like much of the West Coast the area experiences high annual rainfall, up to 6000mm (Norton, 2006), which helps to maintain the wetland. Being around 700m above sea level, effectively in the foot hills of the Southern Alps, heavy snow falls are common in the winter months and chilly winds can blow from all directions.

The low temperatures often cool and condense oceanic air into fog (Norton, 2006) which probably also helps to hydrate the wetland systems. The valley is also subject to powerful storms at times (Lockwood, 2004) yet more than half of the days spent on field work were fine and calm with blues skies or whispy cumulous clouds as can be seen in Figure 1. On the hottest days the refuge of the waterfall pools south of the valley were sought and sighs of relief were heard when the sun dropped behind the hills.

Three field visits were made to Happy Valley in the course of this study. The first was a quick reconaissance trip in early February. The second involved spending a week in the valley in March and another week in late September. It was useful to be able to observe

the differences in climate, and plant and animal life between late summer, autumn and early spring.

This may have been one of the last opportunities for anyone to study the area. Crown-owned mining company Solid Energy New Zealand Limited has gained permission for an open cast coal mine covering the entire area of the upper valley. This development would irrevocably alter the geology, flora and fauna of this pristine, undeveloped ecosystem.

Despite being mentioned in as the primary Recommended Area for Protection in the Department of Conservation (DOC) report on the Ngakawau Ecological District, there has been no detailed ecological study of the upper Waimangaroa. We are not even in a position to give a thorough inventory of the biodiversity we stand to lose.

The obvious landscape features of the valley are the flat, almond-shaped red tussock wetland, surrounded by two fairly steep, ridges of hills covered in scrubland, low forest and patches of scree (see Figure 1). At each end of the valley, the hills are divided by narrow but gently-sloped passes, each containing the bed of one of the valley's two main waterways. The northern end of the valley is the catchment for a waterway sometimes called the upper St Patrick's Stream which flows north-east out of the valley through a shallow gorge (see Figure 2) and into an artifical lake created by St Pat's Dam, whose rusting outflow pipes were seen scattered down Granity Creek.

The waters of the Cypress Stream flows south-west out of the valley to join the Whirlwind, Herbert, Webb and Ernest streams, as well as a number of smaller waterways flowing off the surrounding hills, as a tributary of the Waimangaroa River. Downstream the river plunges through the series of steep, narrow gorges and wider terraces that form the rest of the Waimangaroa Valley. Near Burnett's Face it turns sharply to the north-west to reach its mouth on the north side of the Waimangaroa township.

Geology and soils

The physical configuration of the valley has been formed over thousands of years by the action of a set of tectonic fault systems (see Appendix H) that have been folding and shaping the rocks since at least the Quaternary (Wood, 2004). Bounded to the east by the Paparoa (Mt William) Range, itself the result of the movement of the underlying Mt William fault, the valley is also surrounded to the north-east and north-west by two branches of the Webb fault. This fault is probably responsible for the line of craggy hills and rocks ridges that form the western boundary of the valley and almost close it across the path of the upper St Patrick's stream.

A third fault system also plays a part in shaping the landscape of the valley. The Kiwi fault runs up the western side of the entire Waimangaroa Valley with a branch striking south-east towards the southern end of the upper valley. Another branch has been mapped running south-west across Herbert Stream, not far from where it meets the Cypress Stream coming out of the upper valley and is presumed to be connected to the south-east branch. This system may well have played a part in folding the hills together, forming the gorge that the Cypress must pass through at the southern end of the valley (see Figure 2).

To the east of the Waimangaroa Valley lies the ridgeline that runs between Mt Frederick and Mt Augustus, the site of Solid Energy's current coal extraction operation, the Stockton Mine. The coal being extracted at Stockton is also part of a key aspect of the Happy Valley geological profile, the Brunner Coal Measures, which have their origins in the Eocene. These black, carbonacous layers beneath the hills and wetland, which can be seen in Figure 3 an eroded bank, are the result of organic material collecting as sediment under ancient forests and swamps (Walker, 2003).

Other sedimentary strata that combine to form the Brunner Coal Measures include quartzose sandstones, grit, carbonaceous mudstone and basal conglomerate that formed 40-50 million years ago over the greywacke and granite bedrocks. These layers were turn overlaid by more recent mudstones and siltstones (Norton, 1997).

Examples include the micaceous, blue-grey muddy sandstone which can be seen in Figure 4 with a few fragments of the overlying light brown sandstone. These two layers are part of a regional unconformity called the Blue Bottom group (see Appendix I). The particular combination of materials and topography in these rocks have been mapped at only one other site at Mt Davy's near Westport (Wood 2004).

These sediments were buried deep under the surface and later uplifted, resulting in the erosion of the more recent mudstone and limestone strata in some places exposing spectacular quartzose sandstone pavements. These pavements found in many of the higher and more exposed areas on the hillsides are made of quartz phenocrysts encased in a black sandstone matrix. Many of these outcrops contain sedimentary layers which seem to be made of harder minerals than the surrounding sandstone, forming ridges, fins or crests that stand out from the more rounded eroded surfaces.

This can be clearly seen in Figure 5 which was photographed beside the upper St Patrick's Stream where the sedimentary strata are perpendicular to the original horizontal alignment. These could have been twisted into this position by the action of

the Webb fault. However they are probably large boulders that have been undermined by the stream and broken off the outcrops above where the lines of strata are still close to horizontal although they tend uphill at a 25-30 degree angle towards the north-west.

The stream has carved a u-shaped gorge out of the weaker layers of these rocks through which it exits the valley towards the north-west. Examination of the sides of the gorge reveal a number of layers. Towards the top are flaky white, grey and orange rock which are probably the limestones and mudstones of the Nile Group (see Appendix I). Further down there is a more solid, black rock which may be the carbonaceous mudstone associated with the Brunner coal seams. The tiny silvery flecks in this strata, which can also be seen in the beds of some of the smaller wetland waterways, could be quartz or possibly iron pyrite.

A number of erosion sites were investigated for information about the nature of the soil and rock layers beneath. In some erosion sites a crumbly strata resembling slate could be seen sandwiched between coal seams. Initially it was thought that this 'slate', combined with the harder minerals layers was evidence of metamorphic changes in these rock strata. However this is inconsistent with the unsmudged quartz phenocrysts in the sandstone outcrops and the geology maps make no reference to any metamorphic strata. These slate-like layers and the similar scree on the eroded areas of the valley's hillsides (see Figure 6) may be broken up material from the Nile Group of mudstones and limestones.

The soil has been formed from the decay of plant material and the accumulation of sediments eroded from the ridgelines by the seasonally strong winds and heavy rains. On the hillsides the soil is covered by thick mats of mosses amongst the scub except for bare areas where rainwater is drained. Here the soil has been eroded except where the root mass of small trees have held the soil together, creating small soil islands (see Figure 4) surrounded by bare rock or scree.

Rainwater runs down the steep hills and gathers in small tarns (mountain ponds) (see Figure 7), draining slowly through the water-logged hydric soils and sediments of the marshland and being soaked up by the many water-holding plants like liverworts and mosses. Eventually it feeds into the tiny trench-like waterways that feed the two streams. The Cypress Stream is up to 1m deep in places, varying from wide pools to narrower more rapid-flowing sections. It’s bed is made up of small pebbles and sandy sediment and some larger stones and rocks.

Flora

The nature of the plant communities found in Happy Valley are strongly influenced by three factors. Below ground there are the sour, acid soil conditions created by the coal measure geology, especially the quartose sandstones, which plants must be specialised plants to survive in, let alone thrive in (Norton, 1997). At ground level there is the high water table which creates niches for plants such as mosses, ferns and harakeke which require a damp habitat. From above the ecological pattern of the valley is shaped by a harsh climate with high rainfall, strong winds and low temperatures common, resulting in mature trees the size of small shrubs with divaricating growth patterns.

The flora communities of Happy Valley can be divided into two basic groups; the wetlands along the floor of the valley (see Figure 7), dominated by a unique red tussock (*Chionochloa juncea)* which is confined to the Paparoa (Denniston) plateaux (Knightbride, 2004) and the scrubland on the steep hillsides (see Figure 8), dominated by stunted manuka (*Leptospermum scoparium*), silver beech (*Nothofagus solandri*), and bog pine (*Halocarpus bidwillii*).

These can be further subdivided into streambed, tussockland, herbfield, scree slopes, heathland (on lower slopes), shrubland, and significantly old, low forest communities which according to Atkinson (2004) are some of the most healthy remnants of this forst type in the country. The interpenetration of the various factors that shape the communities create a plethora of ecotones and tangled interpenetrations of small trees, bryophytes, shrubs, herbs and grasses on the borders of the various regions.

Various plant types could also be seen in significant numbers in both wetland and scrubland settings and in the ecotones between them (see Figure 9). One was a red, spiky, narrow-stemmed shrub found growing amongst the wetland and on the hillsides. Initially this was identified as sprawling inaka (or sprawling turpentine scrub, *Dracophyllum uniflorum var. frondosum*) but some specimens seen were upright and up to a metre tall which suggest it is in fact the related *Dracophyllum uniflorum.*

Another was a member of one of the three or four species of insectivorous sundews (*Drosera* genus) found in the valley and the surrounding area (see Figure 8). Many were seen during the autumn both in the bare scree areas of the hillside and amongst the tussockland but few were in evidence in the spring.

Wetland communities

At a distance the red tussock seems to fill the entire valley floor. However a closer look soon reveals a plethora of plant species. For a start the red tussock is not the only grass, other wetland grasses seen include the endemic Carses sedge (*Carex carsei*). Amongst the grasses there are large numbers of raarahu (bracken fern, *Pteridium esculentum*) and a plethora of bryophytes which have been the most difficult to identify. One of the more spectacular was a large orange specimen with clumps of small feathery leaves forming mounds with the branches of other plants poking through.

Many plants in the valley would be much easier to identify with a further visit during late spring when they are in flower or in summer when they are fruiting. An example is new zealand flax, an easily recognisable member of the wetland communities which is common along the stream margins. Without flower it is difficult to tell whether it is harakeke (*Phorium tenax)* or whaririki *(Phorium cookiarum*). Stream beds featured a distinct plant mass, very dark green with feathery green leaves and tiny light green tips about 1mm, filling from quarter to half of the surface area of the bed in places.

Hillside communities

As well as the three dominant canopy trees mentioned above, the forested hillsides are also home are also home to apline horopito (alpine peppertree, *Pseudowintera colorata*) which is not only an endemic species but the genus *pseudowintera* is also found only in Aotearoa. Then there are the mountain beech, pink pine/ yellow pine *(Halocarpus biformis)*, yellow silver pine (*Lepidothamnus intermedius*) and southern rata and pygmy pine *(Lepidothamnus laxifolius*, see foreground and centre of Figure 10) (Atkinson, 2004). The presence of the various small pine species is significant in that these species are known to create ecological niches for a wide range of bryophytes (mosses and liverworts) and according to Lockwood (2004) there are few forests left in Aotearoa with significant populations of these trees.

True to form, the hillsides supports a rich diversity of understory plants including smaller trees/ shrubs, grasses, bryophytes and fungi. One example is the rare red mistletoe (*Peraxilla tetrapetala*) has been identified in the valley (de Lange & Norton, 1995). Another, seen in a number of areas with less dense canopy and on the margins of the scrub was a large, clumpy grass found amongst the scrub and on the margins of the wetland. It had narrow, lime green leaves up to 1m long and black seed heads arranged in bunches on long black and green sectioned stems coming out of the middle of the plant (perhaps *Carex elingamita or Anemanthele lessoniana*?).

Another was a shrub with a thick silvery-grey woody stem. It had very little branching and most of the long, narrow green leaves 6-8cm long with yellow lines up the centre came directly off the stem. Seen occasionally amongst the hillside scrub. On the last day of field work a larger tree was sighted with remnants of the same foliage on its lower branches which suggests that this is acutally the juvenile growth form of this mature tree which proved difficult to identify.

On the eastern hillsides the bush is taller and thicker with a variety of plants not seen on the western side. These included a red-leaved tree closely resembling a Tii Pore (Pacific Island cabbage tree) but with a large brush-shaped flower sticking up from the centre of

the larger specimens, koowaowao (hounds tongue fern, *Phytomatosorus pustulatus*) and a tree I believe was toatoa (*Haloragis erecta subsp. Erecta*). This probably reflect the fact that the eastern hillside is more sheltered from rain and wind. Another hillside plant was the green cushion plant in Figure 11, a member of the genus *Raoulia*, perhaps of the species *australis*.

Knightbridge identifies a variant of the flowering herb Eyebright (*Euphrasia wettsteiniana*) as being endemic to the plateaux. Jury (pers. Comm.) noted that *Ranunculus foliosis* (grassland buttercup) and *exocarpus bidwillii* (Mountain sandalwood), both endemic to Aotearoa, were present in the valley, as well as a rare bearded orchid (most likely *Calochilus paludosus*).

Fungi

Small yellow mushrooms were seen amongst moss beneath the manuka scrub on the western hillside. Their smooth stalks were about 1-3cm in length and their caps about 5mm across with white gill.

Lichens

Lichens are not technically plants but an ancient symbiosis of algal matrices growing on a fungal base. They play a crucial role in the process of soil creation by creating a weak acid which dissolves rocks. A number of species of lichen were observed in the valley including Coral Lichen (*Cladia Retipora*, see Figure 12), Flaky Paint Lichen and Old Man's Beard Lichen.

Exotics

Invasive exotic weeds such as gorse are found in large numbers in the surrounding areas that have been altered by mining and other human activity. Significantly, unlike many remnant native areas, no sign was found of introduced flora in the valley.

Fauna

Mammals

Happy Valley is known to be home to the native and extremely rare lesser short-tailed bat (see Appendix C). A skeleton of a possum was found on the western ridgeline above the valley and there have been reports of deer being sighted but otherwise no exotic mammals have been found in the area. According to Norton (1997) the frequent occurance of trees such as haumakoroa (*Raukaua simple*x, formerly *Pseudopanax simplex*), kaapuka (broadleaf, *Griselinia littoralis*) and pate (*Shefflerra digitata*) are strong evidence of the lack of possum browsing.

Birds

The most commonly seen bird was the endemic western weka (Gallirallus australis, see figure 13). As would be expected with its crepuscular habits I saw weka each day around dawn and dusk. During the autumn visit there was a family of weka including two chicks on the hillside where I was camping. During the spring visit there seemed to be only one weka. Presumably the chicks had by this stage gone off to find their own territory. These weka are believed to be a threatened sub-species, genetically distinct from the Fiordland population.

A number of the animals present in the valley are most active at night and could by identified by their calls. Ruru (Morepork, Ninox novaeseelandiae) could often be heard calling in the early evening. Most nights the calls of a number of the endemic RoaRoa (Great Spotted Kiwi, Apteryx haastii, listed as 'vulnerable') could also be heard, usually later in the evening.

The Pihoihoi (NZ Pipit, Anthus novaeseelandiae, most likely sub-species punctata) are fast-moving, well camouflaged little birds as can be seen in Figure 14. I saw them in significant numbers during the autumn visit but only rarely during the spring visit. Toutouwai (South Island Bush Robin, Petroica autralis australis) and the related Miromiro (South Island Tomtit, Petroica macrocephalia macrocephalia) were also seen frequently during the spring visit, usually at dawn and dusk suggesting a crepuscular habit.

Many other birds have been seen frequently in the area such as the bellbird, tui, fantail, grey warbler, South Island robin, yellow-breasted tit and silvereye. Shining cuckoo, brown creeper, rifleman and kaka have also been sighted (Norton, 1997). Members of the Save Happy Valley Coalition have mentioned seeing Kakariki and Fernbird. New Zealand falcon, kea, kereru and long-tailed cuckoo may also live in the area intermittently but none were seen during field visits.

Reptiles/ Amphibians

Frog calls were heard every evening. Frogspawn were sighted in wetland pools during the late Sept early spring visit, tiny white tadpoles encased in a gelatinous mass anchored to poolside vegetation (see Figure 15). These were probably the Whistling Tree Frogs or possibly Green Tree Frogs (*Littoria ranifornis*). Both species are introduced, originating in Australia, not native to the valley. However their presence and the health of their population is potentially a good indicator that the micro-environment of the valley is relatively free of anthropogenic pollution (Bishop 2006).

The Buller has eight species of lizard and the valley is thought to be home to at least two of them. One is the protected West Coast green gecko, at least two of which have been sighted in Happy Valley (see Appendix C). The other is the a skink species endemic to the coal plateaux. No sightings of living specimens of the the "Denniston skink" have yet been confirmed but the species has been identified by the study of a slough and is considered to be taxonomically unique (see Appendix D).

Fish

No fish were seen during the field visits. Access obstacles to the Waimangaroa may have prevented many locally occurring species becoming established in the valley, Lockwood (2004) mentions natural barriers keeping fish from colonising the waterways of the Paparoa (Denniston) plateaux. The acid nature of the coal-soured soil in the valley may also affect the ability of fish to live here.

However the presence of tadpoles, koura and waterway insects are testament to the health of the aquatic habitat in the valley. Further observation of the waterways and whether fish-eating bird species frequent the valley could potentially discover isolated, land-locked species undergoing a process of speciation.

Invertebrates

The role of the ancient genus of carnivorous land snails called Powelliphanta in studies of the process of speciation provide an excellent example of the way taxonomical standards can be challenged by new information (Walker, 2003). No sign was seen of any living specimens of the Happy Valley species, the endangered *Powelliphanta "patrickensis",* which is unique to its highly specialised habitati in the valley. However many empty shells were seen amongst damp scrub, some with signs of predation, perhaps by weka. Powelliphanta eggs and juveniles are sometimes eaten by roa but they are not known to break the shells of adult snails. Overall this species of Powelliphant is more vulnerable, being relatively smaller than many of its genus (Walker, 2003).

Koura (Freshwater crayfish, most likely the northern variety, *Paranephrops planifrons*) have been seen in the Cypress stream by SHV campaigners and are mentioned in the Ngakawau Ecological District report but were not seen during field visits. A female weta with distinct ovaposter and a number of other weta were seen during the autumn visit. These are most likely to be a variety of the Wellington tree weta (Hemideina crassidens) but could also be West Coast bush weta (Hemideina broughi). A tiny mollusc discovered in the valley, a tiny snail thought to be a member of the genus L*otula,* has never before been described by biologists (SHVC 1, 2006).

Beyond the work on these creatures there has only been one systematic study of inverterbrate life in the valley, a survey of Carabidae ground beetles (see Appendix C). A range of insects, spiders and other invertebrates were seen during the autumn visit but fewer during the spring visit, presumably because of the colder temperatures in the preceding winter. As well as commonly occuring insects like flies, wasps, misquitos and namu (sandflies, family *Simuliidae*) these included:

- A small beetle, about 2cm long, brown with cream stripes on the top of its abdomen, thorax and head. It had long, widely spread antennae and a small set of manibles.
- A small brown spider with long, thin legs and a cigar-shaped body about 1cm long covered with a wood-like pattern. When disturbed it grasped hold of a stick, flattening itself against it and wrapping its legs around it. Many different spiderwebs were seen during field visits indicating the presence of a range of arachnid species.
- A tiny, winged pond-skating insect seen on pools and slower flowing parts of the stream.
- A small aquatic insect resembling a water boatman (family *Corixidae*) seen swimming 5cm below the surface of a small pool.
- A small insect resembling an earwig, about 1 and a half cm in length, glossy black with a jointed abdomen, stubby antennae and three short spikes at the tail end.
- A large insect with a translucent yellow-brown body about 3cm long with a jointed appearance along its back. It had noticably large pedipalps for its size and extremely long, thin antennae, perhaps twice the length of its body. Like the spider is demonstrated a tendancy to flatten its body against the wood on which it for camoflage. It may have been a juvenile tree weta, a new subspecies of weta or possibly a species of grasshopper, perhaps an undescribed southern variant of the short-horned grasshopper (S*igaus piliferus*).

Legal aspects and management

The upper Waimangaroa Valley is 100% publicly owned (see Appendix A). The land is divided into sections held by three different Crown agencies: Department of Conservation (DOC), Ministry of Economic Development (MED) and Land Information New Zealand (LINZ). While the local, regional and national governments have treated the valley primarily as a mineral resource, there have been some concessions to ecosystem protection.

The Surrendered Areas and Areas for Ecological Management (Appendix B) map shows two areas, one adjacent to the DOC owned section (A) and one along the north-western boundary of the two coal pits (B), which are to be surrendered to DOC as part of the access agreement between the Crown and Solid Energy. Area B is part of the Stockton CML and will not be surrended although Solid Energy is expected to minimize disruption to it during mining.

Part of the both the north and south pits of the proposed Cypress Mine are within an area gazetted as state forest in 1970 and currently held by LINZ. The remainder of the two pits are part of a state coal reserve gazetted in 1986 and held by MED, which currently contains the site of the Mt William North Mine. The areas which are to be used to storage of overburden are within the Stockton CML (Crown Mineral License) area which is owned by Solid Energy who have pitched the Cypress pits as an extention of their operation at Stockton (Figure 16).

As of 2000 a coal mining permit for the upper Waimangaroa was jointly owned by Todd Energy (20%) and Solid Energy (80%), although Solid Energy may have since bought out Todd's 20% when it bought out their 50% share in the Spring Creek mine near Greymouth in 2002. Solid Energy applied for resource consent for their proposed open cast coal mine in December, 2003, which were granted in May, 2005 with the blessing of the Buller District and West Coast Regional Councils.

In 2006 the Minister of Conservation, Chris Carter, announced he had granted permission under the Wildlife Act (1953) for threatened species including Roa and Powelliphanta to be relocated or killed by SE during the mining operation. His decision reflected the legal technicality that the mining permits held by Solid Energy were issued prior to the passing of the Crown Minerals and Resource Management Acts (1991). Because of this the application had to be considered under the terms of the Coal Mines Act (1979) which gave no consideration to the environmental effects of mining.

Neither was there any ability for the climate change effects of burning the coal to be extracted from the valley. At the time the resource consents were issued, climate change considerations were exempt from the resource consent process due to a loophole created by the cancellation of the Carbon Tax. The Cypress coal was not even included in New Zealand's emissions under the Kyoto Protocol because it is all for export, an absurd loophole considering that the effects of climate change are felt globally regardless of where the greenhouse gases are generated.

Charged by the Conservation Act (1987) with protecting native species and their habitat, DOC staff originally submitted against the mine. However, despite the fact that

their own experts stated in resource consent submissions that the proposed pest control could not be sufficient mitigation of the habitat lost to the proposed mining operation (van Mierlo, 2004), the DOC Area Manager for the West Coast Conservancy has agreed not to appeal the resource consents in return for Solid Energy funding a predator fence and pest control in a roughly 17 hectare area.

The trapping operation currently being carried out by a contractor, Mike Bygate, as part of this was investigated as part of the field work in the valley. Bright yellow poison bait stations have been placed on the ground along a marked trails around the area, even though DOC standards say they should be placed well out of reach of ground-dwellers. Although the poison used has a low toxicity for birds compared to mammels, there is still a lethal dose. A determined weka is capable of getting its head into the stations, consuming a large number of pellets and becoming very ill or even dying.

The pest control is one of a number of mitigation concessions offered in response to opposition by a number of community and conservation groups including Ngakawau Riverwatch, Te Runanga o Ngati Waewae, Buller Conservation Group and West Coast Forest and Bird. Others include containment and treatment of water, cosmetic contouring of landforms and revegetation.

In response to appeals against the granting of resource consent, the Environment Court has imposed strict conditions on Solid Energy if the Cypress Mine is to go ahead. They must successfully transfer a 12 hectare section of the wetland, store it safely for the duration of the mining activity and return in to the valley afterwards. Only one such wetland transfer has been attempted, in Zurich, Switzerland, and was a miserable failure. Professor Alan Mark of Otago University has stated that it can't be done.

Solid Energy, which is responsible for more than three quarters of the coal extracted from Aotearoa, has a patchy environmental record. It is responsible for acid mine drainage (AMD), coal fines (suspended coal particulate) and other sediments that have rendered the Ngakawau River and a number of its tributaries virtually lifeless. Dead plants can be seen along the banks of the Mangatini stream, killed by steam rising from the water (Lusk, 2004). The Mt Frederick Mine, part of the Stockton Mining Licence area has been a source of polluted seepage containing aluminium, cadmium, copper, iron, lead, nickel, iron and zinc (Atkinson, 2004).

Another example of how environmentally destructive industrial mining can be is the uncontrollable coal seam fire that smoulders away in the lower valley and can be seen from the 4 wheel drive access road used to approach the upper Waimangaroa (see Figure 17). Although it has so far proved difficult to find any records of how and when this fire began, it is well known that some coals can spontanously combust at temperatures below 100 degrees celsius or ignited by natural phenomena such as lightening.

Therefore such fires can have a number of possible causes. Some such fires occur as a consequence of the collapse of underground mines due to 'pillar robbing'. This dangerous mining practice involves trying to remove coal from areas that provide structural support to the mining tunnels, allowing controlled collapse of tunnel ceilings (US Bureau of Mines, 1996). In some cases the coal dust created in the collapse provides ready fuel and the surrounding rocks provide trapped oxygen which is also

released by the collapse. These combine to create spontaneous combustion. The heat of the fire extracts further oxygen from rocks and the coal can continue to burn for many months or years.

These are examples of degradation of the mauri of the environment according to the metaphysical worldview of Maori as discussed in the next section. Other examples highlighted in the resource consent submissions by representatives of Te Runanga o Ngati Waewae, as tangata whenua, on the Cypress proposal include the cut and fill road through an area of sandstone pavement and the undercutting of the Paparoa (Mt William) Range, increasing the likelihood of further subsidence of the landform.

Ngati Waewae desired that the degraded mauri caused by past mining activity should be fully restored before consent was granted for new mines. They believe they have a kaitiaki responsibility to advocate for the land in a holistic manner and that all planned mines on the plateaux should be considered as a whole, so that decisions are not biased in future by the industrialisation of the landscape during the mining of Cypress. They also asked for consent, if granted, to be limited to ten years so as not to bind future generations without consultation.

Ngati Waewae consider it their duty to participate in resource management processes due to references to Te Tiriti o Waitangi in such legislation and policy as the Resource Management Act 1991, Conservation Act 1987, State Owned Enterprises Act 1986, West Coast Regional Policy Statement 2000 and others. They also expressed frustration that although Solid Energy funded a Cultural Impact Assessment they failed to provide copies to the local authority commissioners in advance of the consent hearings (Weepu, 2004).

History, people and philosophy

History

Te Runanga of Ngati Waewae, a hapu of the Ngai Tahu iwi, are the tangata whenua of the Tai Poutini. Their rohe (sphere of influence) includes most of the West Coast, from the north banks of the Poerua River to Kahurangi Point and inland as far as Tiri Tiri o te Moana, the Main Divide (Weepu, 2004).

Ngai Tahu were initially attracted to the area by mineral resources, particularly pounamu, although they also knew of the presence and some of the uses of coal. Prior to the arrival of European the tupuna (primary ancestor) Tuhuru aquired mana whenua for Ngati Waewae from the previous inhabitants who are likely to have been the earliest human visitors to the Waimangaroa area (Barber, 2004).

There is no record of habitation in the valley and the unforgiving climate would make it an unlikely site for permanent dwellings. However the valley is part of an ancient trail to the Orikaka area and a source of wai maori (drinking water) and mahinga kai (food gathering) including birds and plants (Norton, 1997). It is likely that one of these was aruhe, the roots of raarahu (bracken fern), which is plentiful in the tussocklands of the valley and was one of the most important foods for Maori in pre-European times. The aruhe was dried, soaked, dried again, then roasted and either eaten like this or pounded and rolled into bread sticks which were roasted again and would keep well for some time (Crowe, 2004).

Although the Paparoa (Denniston) coal plateax have a long history of coal mining, the first mineral to attract miners was gold which was discovered in 1860 in the Waimangaroa River (Norton, 1997). In fact it was gold miners who gave the damp and often cold valley the ironic name 'Happy Valley'. The remains of the Britannia Gold Mine at the head of Britannia Stream can still be found just to the north-west of the DOC-owned section of the valley.

According to the Solid Energy Buller history page it was Heaphy and Brunner, for whom the Brunner coal measure were named, who first discovered coal in the Buller in 1848 (SENZ 1, 2004). However Norton (1997) states that the first coal was found by a pair of geologists Haast and Burnett, after whom the mine and town of Burnett's Face was named.

A Te Ara Encyclopedia article on coal mining confirms that Brunner found coal in the Grey River in 1848 and recognises Haast's contribution as identifying the potential of the Paparoa (Denniston) plateaux in 1860 (Sherwood, A & Phillips, J, 2006). Initial investigations estimated that the fields contained an estimated 70 million tonnes of coal which could be extracted for human use (Burnett, cited by Norton, 1997). The first of the Paparoa (Denniston) plateax coal mines began extraction near Seddonville in 1862.

Although the early coal mining period peaked in about 1920, the practice of open cast mining and the availability of more powerful extraction technology has allowed the industry to grow again in contemporary times. The major player in this revival is Solid Energy, a state owned enterprise which began mining as State Coal Mines at Rewanui in 1901 (SENZ 2, 2004). In 1987 it became Coal Corporation NZ Ltd and in 1997 and

Solid Energy in 1997 (Norton, 1997).

People

Currently the valley is not regularly used by the local population although the wider area is a site for recreational activities such as 4 wheel driving and hunting. Local opinion seems to perceive the area as an nondescript piece of scrubland with no special qualities. Having never visited the valley themselves, locals will usually dismiss an invitation to do so with the excuse that they have no interest in visiting a "wasteleand".

The main human presence in the valley at present is in the form of an occupation camp maintained by campaigners from the Save Happy Valley Coalition (Appendix F). Although this camp which began in January 2006 has had a noticable effect on the area in the form of the cutting and tramping of trails through scrub and wetland and alteration to the area around the camp (see Figure 18), the campaigners point out that this low impact activity can be tolerated by the ecosystem whereas the open cast mine would utterly destroy them.

Philosophy

Ngati Waewae made reference in their resource consent to mining being an affront to their cultural values for a number of reasons. Specifically they mentioned that major human alterations to the landforms affects the mauri (life force inherent in all things) which in turn detracts from the mana (pride and esteeem) of the hapu and iwi (Barber, 2004).

In Maori oral history the landforms of Te Wai Pounamu (South Island) were the work of the atua Tu Teraki Whanoa and implied that carving up the geographical features of the landscape show disrespect for his creation (Figure 19). The maunga (moutains) also hold the names of tupuna (ancestors) and this is part of their status as wahi tapu (sacred sites).

Another important Maori metaphysical concept that comes into play in discussions of resource management is wairua, which describes the binary, yin/yang nature of all things in the world. For example the need to embrace the new while still taking care to safeguard the old. The concept of wairua also includes the symbiotic relationship between people and Papatuanuku, the Earth and the need for humans to respect and care for her and she nurtures us (Weepu, 2004).

A major cultural issue for Waewae in their role as kaitiaki is the mixing of water from different catchments and of wai maori (clean water) with water contaminated by the mining. For Maori the mauri of each waterway is a unique result of the land from which the headwaters flow and mixing different waters creates problematic spiritual imbalances. These imbalances can also be measured ecologically by looking at the effect on aquatic flora and fauna when waters with different chemical profiles and temperatures are mixed.

Finally there were implicit references to the concept of rahui, the closure of a resource to allow regeneration. Rick Barber asserted that a debt is owed to the native species of the Paparoa (Denniston) plateax for the contamination that still persists from past

mining activity and that the mitigation plans for plants and animals proposed by Solid Energy were a poor way to pay this debt, especially in the case of Roa which they revere as a "taonga species".

Although there is much misunderstandingof Maori metaphysical worldviews all around the country the West Coast is an area where value systems that diverge strongly from the land-breaking pioneer ethos are held in particularly harsh contempt. This dogmatic and polemical cultural habit is also a problem for people who advocate for environmental conservation on the Coast where it potentially conflicts with economic development.

There are vocal factions among the residents of the coast and particularly the Buller area who go to significant effort to depict conservationists as outsiders imposing their sheltered, big-city views on Coasters. This is despite the fact that three of the harshest critics in the letters pages of the Westport News are believed to have moved to the Coast from elsewhere and there are conservationists involved in the Save Happy Valley campaign live who locally and others grew up in the area and still have family there.

The Save Happy Valley Coalition, an informal grouping of groups and individuals have built a campaign around saving the valley from the Cypress Mine. The coalition includes members of local groups like Buller Conservation Group and the west coast branch of Forest and Bird as well as environmental activists from other parts of the country and member of national groups like Greenpeace and the Green Party.

For the eco-activists protecting the valley is about something more fundamental than its amenity value to humans. Many environmentalists see the plants and animals of the valley as having an intrinsic right to life which should be respected over and above the the desire of humans to extract resources from under their habitat. Like tangata whenua, some environmentalists see the ecosystem as a whole, including the hydrology and landforms as a gestalt entity with its own 'life' and thus a right to be free from wanton destruction by humans (Figure 20).

Some factions within the coalition also describe themselves as anticapitalists. For these activists the focus is on Solid Energy as a profit-making entity and their criticisms attack not only the company's environmental management but its treatment of its workers and lack of concern for the well-being of the local community or the opinions of locals opposed to its developments.

The anticapitalists do not see generating public pressure on the government to stop Solid Energy as a realistic means of stopping it from mining the valley. This is because they see the government, state-owned enterprises and private business as being part of an interdependent system - 'capitalism', just as the plants, animals, waterways and minerals of the valley form an integrated ecosystem. In their view the government are as likely to want their economic base undermined by stopping the mine as the species in the valley are to want their habitat undermined by the removal of the coal.

Coast-based conservationists report that they often receive positive feedback about their work from other locals who are either sitting on the fence, seeing merit in both sides of the argument or are supportive but nervous about becoming publicly associated with the campaign. Buller Conservation Group media spokesperson Pete Lusk finally stepped

down from his role after a campaign of personal attacks in the newspaper escalated to an explosive devices being detonated in their letter box of his family's home.

Ironically this vigilante act, designed to protest an opposing view through property damage, is arguably an example of the 'direct action' philisophy advocated by the anticapitalist environmentalists. 'Home demos' where groups pickets the homes of corporate CEOs, breeders of animals for vivisection, organisers of weapons conferences and other activist targets have become increasingly common.

As described above there is a spectrum of views between the extremes of campaigners who prefer to oppose mining through legal action, lobbying of government and public awareness and those who prefer pickets, lock-ons, monkey-wrenching and occupation. Arguably a parallel spectrum exists between Coasters who prefer to defend mining by rhetorical argument and resource management process, and those who feel strongly enough to carry out property destruction.

While the Coasters are concerned with defending the wellbeing and local autonomy of their communities and their economic future, the conservationists are equally concerned with protecting the ancestral homes of the plant and animal communities and their ecological future. Having these two interest groups at loggerheads benefits Solid Energy and the transnational corporations to whom they sell coal.

Coasters accuse conservationists of imposing their 'greenie', collectivist views from outside and activists stereotype locals as selfish, parochial 'rednecks'. Meanwhile both groups turn out to be wrong as decisions about the resources of the Coast are being made in boardrooms in Christchurch and Wellington and not by locals or greens.

Discussion, recommendations for management, conclusion

Discussion

Prior to embarking on the first week long field trip, emails were sent to all three landowners, asking permission to visit the area for study purposes. Bob Dickson, Buller Area Manager for DOC replied that permission is not needed to make an ecological survey of the DOC-owned sections of the valley (Appendix E). LINZ replied that since Solid Energy have an access arrangement over the valley an application for permission would have to be made to a third party, Lakes Property Services, Queenstown. MED did not send a reply.

Solid Energy have both political and economic motivations to block any further ecological study of the valley in case it should interfere with their ability to mine it. I considered focusing on the piece of land owned by DOC but there are no black lines drawn across the landscape of the valley. The plants, animals and geographical features do not confine themselves within surveyed boundaries and I believe that everyone has a moral right to visit and record observations as one of the collective owners of public land in a democratic society.

This right becomes a responsibilty when the evolving statuatory mechanisms for protecting the environment from profit-motivated, short-sighted and anthropocentric decision-making mandated by the constitutional structure of corporations are prepared to give a green light to the destruction of pristine wetland habitat. Wetland conservation is a crucial issue for conservationists in this country. Around 90% of the original wetlands in Aotearoa have been lost to invasive weeds (DOC, 2006) or drained and land-filled for farmland, residential and industrial development. Of the remaining wetlands very few remain in at montane and subalpine elevations.

As the result of appeals by a number of community and conservation groups including Ngakawau Riverwatch, Te Runanga o Ngati Waewae, Buller Conservation Group and West Coast Forest and Bird, the Environment Court has imposed strict conditions on Solid Energy if the Cypress Mine is to go ahead. They must successfully transfer (how much?) of wetland, store it safely for the duration of the mining activity and return in to the valley afterwards. Only one such wetland transfer has been attempted, in Zurich, Switzerland. It was a miserable failure and Professor Alan Mark of Otago University has stated that it can't be done (SHVC 2, 2006).

Many of the native tussocklands of Aotearoa have been decimated by the grazing habits of introduced herbivorous mammals and invasion of their niche by introduced grasses (Lowther, 2002). The presence of almost no introduced predators and plants because of other natural barriers like climate, altitude, and remoteness means the health and diversity of the red tussock communities are well above average (see Figure 21). The presence of stable populations of nationally significant threatened species like Roa, Kaka and Powelliphanta gives the valley status as habitat far beyond the numerical significance of those populations.

Jury notes in his summary of the DOC report on the Ngakawau Ecological area,

including the Waimangaroa valley, that one of the most ecologically significant aspects of Happy Valley is its role an a wildlife corridor between surrounding habitats such as the Orikaka ecological area further inland and the Mt Frederick State Forest towards the coast. He says that the valley was seen by DOC's scientists as having healthy long term prospects as a sanctuary due to its size and the protection offered by the slopes separating it from degraded areas like Stockton (see Appendix D).

The SaveHappeyValley website (SHVC 3, 2006) features a quote from Dr John McLennan, the kiwi expert hired by Solid Energy to prepare the wildlife aspect of their Assessment of Environmental Effects for the resource consent hearings, which is worth reproducing in full. "The populations in natural refuges are expected to persist for longest, and to progressively increase in conservation status as those in other areas disappear. Such populations are therefore worthy of special protection, and every effort should be made to prevent avoidable losses, irrespective of the number of individuals involved."

The Solid Energy predator control plan (SENZ 3, 2004) is a tacit admission that the mining operation will create opportunities for incursion into the valley by exotic predator species such as cats, stoats, possums and rats and weeds like gorse which have actively colonised roadsides in other parts of the plateaux. This avoidable action would destroy what is currently exactly the sort of natural refuge for kiwi and other species Dr McLennan refers to, condemning local populations to gradual decline and death. Potentially it could being about the extinction of endemic subspecies or even entirely undiscovered species yet to be formally described.

Underground mining would certainly be less disruptive of the existing ecology than an open cast pit. However even if it were not for the shallowness of the coal seams making underground mining unsafe, the coal measure geology of the valley plays a crucial role in providing the conditions that allow these habitats to exist and support a particular range of plants and animals. The acid, infertile soil and the poor drainage through the sedimentary rock create the basis for the specialised plant and animal species and the wetland hydrology they depend on. Underground mining would likely interfere with these properties as well as doing nothing to address the climate change aspects of the mined coal.

More than one million tonnes of coal are currently being extracted from the Paparoa (Denniston) plateaux each year (Norton, 1997). Predominantly this comes from the Stockton Mine which includes Mt Frederick and the Mt Augustus ridgeline, the only known habitat of the carnivorous land snail *Powelliphanta "Augustus"*.

The Biodiversity Committee of the Royal Society wrote to the Minister of Conservation asking that a moratorium be placed on habitat destruction on Mt Augustus until the survival of the species in the remnant and substitute habitats can be confirmed. Despite this advice from one of the most respected scientific bodies in the country, the Minister also signed away the opportunity to ensure the survival of this *Powelliphanta* species and at the date of writing hundreds of snails are being stored in plastic containers, in a refridgerator, in the Hokitika DOC office.

Various coal mine workings are scattered about the Ngakawau area including, Burnett's Face near Denniston, Whareatea, Mt William North Mine, and Mine Creek near

Millerton. As newer, more powerful extraction technology becomes available and the increasing global energy demand pushes demand up and supply down, lifting prices, some of them are under consideration for re-opening (Cypress Assessment of Environmental Effects cited by Lusk, Pers. Comm.).

Solid Energy also has plans to open a number of new underground mines at Blackburn Pakihi, south of the valley under the Paparoa (Mt William) Range, open cast pits further down the Waimangaroa River, one of which is near the burning mine, and further mountain top removals comparable to Mt Augustus on Mt William and the western slopes of Mt Rochfort (DOC, cited by Lusk, Pers. Comm.).

The contemporary population of Westport and the surrounding area currently rely heavily on coal mining and related activity for their income and thus their livelihood. This is often raised as a criticism of campaigns against resource extraction in the area with conservationists regularly being accused of trying to shut down the Coast.

Almost anyone willing to stand up and speak in the Westport area is supporting the mining of coal which will contribute to climate change when burnt. Yet the town is barely above current sea level and likely to be inundated if global warming continues to raise sea levels. This will not effect Solid Energy who are headquartered in Ootautahi (Christchurch) and whose top management have international connections that will ensure they continue to find work in corporate management somewhere in the world.

The same lack of concern for the sustainability of local communities can be seen in the decision by Solid Energy not to offer work to members of local conservation group Ngakawau Riverwatch who they had employed previous to their becoming concerned about the effect of AMD and coal fines on the nearby waterways. While these workers struggled to find employment Solid Energy was bringing in workers from places as far afield as Nelson and Ootautahi who take their pay back to their own area for the weekend .

Besides this, coal mining by its very nature is not an industry with a future. Even if it is allowed to continue until all the available coal is mined it must eventually end. If the people of Westport are not capable of over-coming their dependence on the trickle-down from the profits of corporate resource extractors like Solid Energy, then sooner or later the Coast will shut down.

Further south in Greymouth and Hokitika and to the north in Granity and Karamea, tourism, arts, crafts and other new livelihoods play a much greater part in the economy and attitudes towards environmentalists have softened somewhat. The Coast has the potential for organic farming for food, timber, fibre and biofuel production for both local needs and export around Te Wai Pounamu and beyond. Both terrestrial and marine areas could be used for primary production if it can be developed in a wholistic and eco-sensitive way.

Their pioneering history suggests Coast communities are made up of hardy, resourceful people with a strong co-operative spirit and a can-do, DIY attitude. If they are capable of making the transition now to a locally-controlled economy based on sustainable practices, why not start now and invest the money which would be spent on open casting Happy Valley in that instead?

Recommendations

Considering the valley's value as a natural refuge, I support the recommendations in the Recovery Plans for Powelliphanta (Walker 2003) that the upper Waimangaroa Valley and the surroundings areas, like other Powelliphanta habitat, be protected from further mining activity, road building and fires. Since the Cypress Mine would definitely involve two of these and increase the likelihood of the third, I think action needs to be taken to revoke the resource consent given to Solid Energy to develop the mine. Instead the valley should be set aside as a wildlife reserve and placed under the management of DOC - a mainland island that will not need to be fenced

Conservation work could extend the capacity of the valley as a wildlife corridor by selectively re-establishing appropriate species sourced from within the valley in the surrounding area and engaging in weed control, possum control and where possible landform restoration and cleaning up pollution left over from past mining.

The openness of the reserve means some careful thought would have to be given to the issue of public access. The disruption of a similar number of casual trampers moving through the area as have visited the protest camp is a potential threat to the ecosystem, creating paths which could be followed by exotic animals or colonised by introduced plants. On the other hand perhaps funding could be obtained to build non-destructive wooden walkways through the valley, creating a day walk that could be joined to other walkways visiting historial and natural heritage sites in the area.

Considerations for wooden walkways include safety, maintenance and appropriate materials. The walkways would have to be strong and durable but treated timber that could alter the chemical balance of the wetland needs to be avoided. Perhaps a naturally moisture resistant timber could be used and a program of regular track inspection established. As well as giving the public the opportunity to visit and appreciate the unique beauty of the area, this could create sustainable livings in guiding tours like those provided by the existing Stockton Mine tour company, and walkway construction, maintainence.

The Coast has a strong engineering culture and some Coasters have already begun to experiment with household scale energy systems utilising renewable resources. Wind turbines, solar hot water systems made from recycled materials, and biodigesters to make gas for cooking or electricity generation from food scraps, garden waste, and farm waste can all be found today on the properties of forward-thinking Coasters. With a co-ordinated effort and some modest investment, they could potentially develop community-scale energy systems involving low-impact hydro-electric or hydro-motive systems, efficiently burning organic waste products to generate electricity or biodigesting them for gas, larger wind turbines in strategic areas or technology to harness the Coast's abundant wave power.

Coasters need homes like the rest of us but they don't need to build them from pre-fab modules imported from Canterbury, Nelson or Otago. Energy-efficient, well-insulated houses which take advantage of passive solar principles for warmth and provide space for kitchen gardens could provide work for innovative builders and help people cut down on energy and food costs. The development of edible landscape properties and

community gardens could create work for creative local gardeners, reduce people's food costs and improve the freshness, taste and nutritional qualities of their diets.

Rather than using their engineering and geological knowledge and heavy machinery to remove habitat for raw materials, Coasters could apply themselves to developing safe and efficient methods for recycling materials already in circulation or reclaiming materials from landfill. Jobs lost from coal mining could be replaced with jobs in dump mining and zerowaste initiatives.

Conclusion

The perception that workers and greenies will always be caught in irresolvable deadlocks is one that serves an elite of political and economic interests. In reality workers cannot continue to carry out work of any kind of this planet without a living biosphere to sustain them and environmentalists cannot survive to study and protect the environment without the contribution of working people to a social economy.

Finding synthesis between the needs and priorities of on each side of this cultural faultline will be a challenging and sometimes frustrating process but one that must be navigated if humanity and the ecosphere we depend on are to survive. One important tool is awareness that such faultlines are a self-perpetuating aspect of the consumer society in which we are divided against ourselves and each other to prevent habits of community co-operation which would compete with commodified products and services provided through the market economy by increasingly alienated and globalised corporate structures.

To begin to understand the relationships between the different components of an ecosystem creates the potential to envision a social order based on a similarly interdependent social that doesn't keep score and refuse to feed its stomach for doing no work. Documenting some of the unique features of this ecosystem of the upper Waimangaroa and its interactions with human society has been a challenging but rewarding experience. Not only have I learned a great deal about describing ecological systems but I have created a document which I intend to continue evolving as the time for further research and field work allows.

At worst I will have created a permanent record of Happy Valley in its pristine state. At best this document could help to convince the public and their representatives in government that this piece of natural heritage has intrinsic value worth preserving and is of greater lasting value and importance than the profits to be earned from mining it. The final decision belongs to the members of the public who are exposed to the arguments in defence of the valley as to whether it is worth putting time aside to help preserve it.

References

Print

Crowe, A. (2004) *A Field Guide to the Native Edible Plants of New Zealand*. Penguin Books.
Walker, K. J. (2003). *Recovery plans for Powelliphanta land snails 2003-2013*. Department of Conservation.

Webpages

Atkinson, V. (2004). *Resource Consent Submission on Cypress Mine on behalf of Greenpeace.*
http://www.savehappyvalley.org.nz/vanessa_atkinson (accessed 20/10/2006)
Barber, R. (2004). *Resource Consent Submission on Cypress Mine on behalf of Te Runanga o Ngati Waewae.*
http://www.savehappyvalley.org.nz/rick_barber (accessed 20/10/2006)
Bishop, P. (2006). *New Zealand Frog Survey*.
http://www.otago.ac.nz/Zoology/research/bishop/frogs/index.html/ (accessed 11/10/2006).
DOC. (2006). *Pests and Weed – General Information*. Department of Conservation.
http://www.doc.govt.nz/Conservation/002~Animal-Pests/001~Pests-and-Weeds-General-Information.asp/ (accessed 20/10/2006).
Knightbridge, P. (2004). *Resource Consent Submission on Cypress Mine on behalf of Department of Conservation*.
http://www.savehappyvalley.org.nz/philip_knightbridge/ (accessed 20/10/2006)
de Lange, P. J. & Norton, D.A. (1995). New Zealand's Loranthaceous Mistletoes.
http://nhf.govt.nz/publications/004~science-and-research/Miscellaneous/PDF/NZmistletoe1.pdf (accessed 20/10/2006)
Lockwood, T. (2004). *Resource Consent Submission on Cypress Mine on behalf of Royal Forest and Bird Protection Society Inc*.
http://www.savehappyvalley.org.nz/tony_lockwood/ (accessed 20/10/2006)
Lowther, B. (2002). *Methods for Restoration of Depleted Tussock Grasslands, AgResearch*.
http://www.tussocks.net.nz/BiodiversityandRestoration/resrev_pap.html/ (accessed 20/10/2006)
Lusk, P. (2004). *Resource Consent Submission on Cypress Mine on behalf of Buller Conservation Group.*
http://www.savehappyvalley.org.nz/pete_lusk (accessed 20/10/2006)
McLintock, A.H. (1966). *An Encyclopaedia of New Zealand.*
http://www.teara.govt.nz/1966/H/HistoryDiscoveryAndExploration/SouthIslandExploration/en (accessed 20/10/2006)
Martin, W. (2002). *The Flora of New Zealand. The Lichens*.
http://www.herbdatanz.com/Lichens_of_NZ.htm/ (accessed 20/10/2006)
van Mierlo, D. (2004). *Resource Consent Submission on Cypress Mine on behalf of Department of Conservation*. http://www.savehappyvalley.org.nz/dean_van_mierlo (accessed 20/10/2006)
Norton, D. (1997). *The Hidden Coal Plateaux of the Buller*. Forest and Bird Magazine, May, p.27
http://www.forestandbird.org.nz/publications/magazine/1997/may/bullercoal.asp/

(accessed 11/10/2006)
SHVC 1. (2006). *Happy Valley.* Save Happy Valley!
http://www.savehappyvalley.org.nz/happyvalley_valley (accessed 11/10/2006)
SHVC 2. (2006). *Save the Wetlands*. Save Happy Valley!
http://www.savehappyvalley.org.nz/pr_04-02-06_shvc (accessed 11/10/2006)
SHVC 3. (2006). *Solid Energy and their Proposed Mitigation*. Save Happy Valley!
http://www.savehappyvalley.org.nz/happyvalley_solid_energy (accessed 11/10/2006)
Sherwood, A & Phillips, J (2006). *Coal and coal mining.* Te Ara - the Encyclopedia of New Zealand, updated 18-Oct-2006
http://www.TeAra.govt.nz/EarthSeaAndSky/MineralResources/CoalAndCoalMining/en (accessed 20/10/2006)
SENZ 1. (2004). *About Solid Energy. Industry History: Buller*
http://www.solidenergy.co.nz/ab-history-buller.htm (accessed 20/10/2006)
SENZ 2. (2004). *About Solid Energy. Industry History: Greymouth*
http://www.solidenergy.co.nz/ab-history-greymouth.htm (accessed 20/10/2006)
SENZ 3. (2004). *Predator Control Plan*.
http://www.solidenergy.co.nz/download/EnvironmentPlans/PredatorControlPlan.PDF (accessed 20/10/2006)
Todd Energy. (2000). *Coal History*.
http://www.toddenergy.co.nz/te/pages/main/coal/industrial/coalhistory.htm (accessed 20/10/2006)
US Bureau of Mines. (1996). *Dictionary of Mining, Mineral and Related Terms. US Department of the Interior*.
http://www.maden.hacettepe.edu.tr/dmmrt/ (accessed 20/10/2006)
Weepu, T.W. (2004). *Resource Consent Submission on Cypress Mine on behalf of Te Runanga o Ngati Waewae.*
http://www.savehappyvalley.org.nz/te_whe_weepu (accessed 20/10/2006)
Whitaker, T. & Lyall, J. *Conservation of lizards in West Coast/Tai Poutini Conservancy*.
http://www.conservation.govt.nz/Publications/004~Science-and-Research/Miscellaneous/PDF/WClizards.pdf (accessed 20/10/2006)
Wood, C. (2004). *Assessment of Environmental Effects: Critique of the Cypress Mine Rehabilitation Plan Proposed by Solid Energy New Zealand Ltd*.
http://www.savehappyvalley.org.nz/carolyn_wood/ (accessed 20/10/2006)

Acknowledgements

First I'd like to give recognition to Te Runanga o Ngati Waewae, the takata whenua and kaitiaki of Te Tai Poutini.

Thanks to Pete, Carolyn and Danielle for friendship, facilitating my field trips into Happy Valley and helping with species identification and historical/ philisophical analysis. Thanks to all the volunteers and groups of the Save Happy Valley Coalition, especially those who I shared camp with during my field visits, and the other conservation groups that support the campaign to save the valley including Buller Conservation Group, Forest and Bird, Greenpeace and the Greens, kia kaha koutou.

Special thanks to Graham Jury for help with species identification and chaining himself to the Hokitika DOC office in solidarity with the Powelliphanta “Augustus” snails.

Thanks Pat Roberts and Associate Professor John Bradshaw of the Geological Sciences faculty at the University of Canterbury for supplying copies of topographic and geological maps. Thanks to the New Zealand Plant Conservation Network whose website I used for much of my plant identification.

Finally thanks to John Green and Bob Dickson of DOC for their help in clarifying study permission rights on the DOC-owned sections of Happy Valley.