Issues facing Southland's wetlands—recommendations for future management

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by

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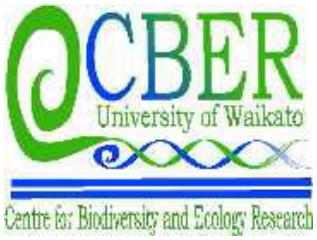

Issues facing Southland's wetlands—recommendations for future management

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Executive Summary

This report summarises our experiences and recommendations from a week-long series of fieldtrips and workshops focused on Southland's wetlands.

Our major **recommendations** are:

- Priorities must be developed for wetland protection and restoration, according to which wetland systems have suffered the greatest losses and which are least represented in the reserves network.
- The development of educational and interpretive resources and programmes will help to raise the level of awareness of the unique values of Southland's wetlands amongst landowners, local authorities and the public, and will provide opportunities for regional promotion and ecotourism.
- There is a need for more research to: increase levels of understanding of wetland development and function; threats from weed invasion and effective control methods; and to design and monitor effective restoration efforts. Some of this research could be achieved thorough ongoing communication with PGSF-funded research organisations and universities, eg. BSc (Hons) and MSc thesis topics.
- Protect the hydrological functioning of wetlands, by developing guidelines for drainage practices in land adjacent to wetlands, and reducing nutrient loading of surface and groundwaters flowing into wetlands.
- Incorporate principles of wetland protection into regional and district plans.

1. Introduction

In January 2003 the Department of Conservation Southland Conservancy hosted a seven day programme of field trips and workshops focused on issues facing wetlands in the Southland Plains Ecological District. Three Waikato scientists, Bev and Bruce Clarkson, ecologists with wide experience in wetlands, and Dave Campbell, a hydrologist with expertise in peatland systems, were sponsored to attend. Funding was provided by the Department of Conservation, Environment Southland, Southland District Council and Nature Heritage Fund.

In this report we provide an overview of the issues facing Southland's wetlands as we perceive them and record our recommendations for future management.

An additional report (Department of Conservation and Environment Southland, 2003) summarises the key outcomes of a field day and workshop for community groups held on 16 and 17 January 2003.

2. The significance of Southland's wetlands

Approximately 10% of New Zealand's former wetlands remain. The greatest losses have occurred in the lowland zone where wetlands have been drained and converted to farmland. Many of the remaining wetlands continue to be modified by grazing and weed infestation. Prior to the arrival of humans, the Southland environment, with its cool predominantly maritime climate and extensive flood plain landscapes, was especially favourable for wetland formation. A wide range of wetland types was present, from swamps, fens and bogs to estuaries, lagoons and dune lakes and dune slacks. There were also extensive areas of flood plain and terrace forests. Together all of these ecosystems formed a diverse landscape mosaic with complex gradients between salt and freshwater and transitions from terrestrial to aquatic environments. As in other parts of New Zealand, many of Southland's wetlands have been converted to farmland. Unlike some other parts of New Zealand, however, it is still not too late to protect and enhance those remaining. In this regard, Southlanders are in an enviable position. In the Waikato, such a large proportion of wetlands have been lost that serious steps are now being taken to restore those remaining, or even recreate some of

them from scratch. Many of the natural processes that created the wide diversity of Southland's wetlands have ceased to exist, with river channelisation, flood control and drainage. However, the remaining wetlands range from regional and national to international importance. In many cases they act as rare reservoirs of indigenous biodiversity, which have been severely depleted or lost elsewhere. Southland's alluvial terrace forests for example, probably contain the greatest concentrations nationally of threatened divaricating shrubs characteristic of such sites. However, wetlands do not need to be internationally significant to warrant protection and enhancement. They simply need to be significant within the district.

In all cases the key to protecting or restoring wetlands is to protect or restore their hydrology. The water table is the key environmental variable, particularly in peat wetlands, and this is heavily impacted by drainage. The over-drained margins of peat wetlands are easily invaded by gorse and other exotic species that would otherwise not normally establish in the wet, low nutrient conditions. Consideration should be given to modifying the drainage practices of land adjacent to wetlands and to buffering and enhancing wetland margins by 'softer' farming practice.

The key to protecting or restoring wetlands is to protect or restore their hydrology.

We identified many wetlands threatened by weed infestations, and there is the potential for these invasions to get worse. However compared with other regions of New Zealand Southland does not have a huge problem and it is not an impossible task to remedy the situation. Thankfully, grey willow has apparently not yet reached Southland wetlands. Many North Island wetlands have been completely invaded and transformed by grey willow, and it is an extremely difficult and expensive weed to eliminate.

Restoration and active management are crucial to saving Southland's wetlands, and in many cases it is not difficult to accomplish this goal. Peat systems are fragile, easily lost but almost impossible to recreate from scratch. The focus should then be on protecting and restoring those that are left. Swamps, while poorly represented in Southland today, are easily drained and cleared, but fortunately they are also easier to create or restore.

Recreational hunting and fishing has led to the setting aside and protection of large areas of wetland habitat. Increasingly Fish & Game managers are

becoming ecosystem managers concerned not only with individual species but also with monitoring healthy functioning ecosystems.

Southland should grasp this opportunity to protect and showcase its wetlands.

Finally, ecotourism has significant potential as an income earner in Southland. Tourists, both domestic and overseas, are on the lookout for these areas, they want to see authentic parts of New Zealand, appreciate the indigenous flora and fauna, be able to fish and hunt, or escape the stress and crowds of everyday life. Southland should grasp this opportunity to protect and showcase its wetlands while also achieving social and economic benefits.

3. Issues facing Southland's wetlands

During five days of field trips in Southland we visited a wide range of wetlands. For each wetland we identified the key positive values and negative aspects, and made some brief recommendations (see Appendix). In this section the key issues facing Southland's wetlands are discussed, some of these relate to environmental factors or agricultural practices, while others are political or socioeconomic in nature.

Drainage

Minerotrophic wetlands[1], or swamps, that once covered vast areas of the Southland Plains have largely been completely destroyed by drainage and river diversion. There are very few intact systems left; therefore there is enormous value in protecting what remains. Similarly, coastal lake wetlands such as Big Lagoon have been heavily modified by altered drainage.

Drainage is also the key factor that threatens peat or ombrotrophic wetlands[2]. Most remnant peat bogs are ringed by deep drains, and many have networks of internal drains (Figure 1), reflecting both past and present-day efforts to develop them. In many cases we visited peat bogs that appeared to have covers of healthy peat-forming vegetation such as wire rush. Beneath the surface, however, the peat told us a story of vegetation change and peat degradation driven in most cases by drainage. We saw examples of peat

[1] Minerotrophic wetlands are rich in nutrients because they are fed by mineral-rich groundwater or sediment-laden flood waters.
[2] Ombrotrophic wetlands are nutrient-deficient because they have accumulated sufficient depths of peat to elevate their central portions above the regional groundwater table so that they are solely fed by rain water.

formed by moisture-loving *Sphagnum* now dominated by dense covers of *Empodisma minus*, a change driven by the ecosystems drying out under the influence of drainage. Some of these peat systems have probably stopped accumulating peat: instead of playing their millenniums-old role as sinks of atmospheric carbon, they may now be releasing tons of carbon per hectare per year to the air.

Figure 1 Deep internal drains at Dunearn bog. Photo: Dave Campbell.

Deep drains adjacent to bogs present real threats to the ecosystems because of lowered water tables, peat degradation, and weed infestation in these marginal areas. In general it seems that drains in peatlands in Southland are far too deep, from any perspective. Deep drainage in the Waikato causes excessive peat shrinkage and oxidation, and loss of plant productivity in summer. Current guidelines recommend that optimum water table depth for maximum pasture production in the Waikato is 30 cm (Environment Waikato, 1999).

Develop guidelines for optimum water table depths under drained peat soils.

Weed invasion

We were told that it is easy to spot remnant peat bogs in Southland by the dense edge of tall gorse. While gorse is a serious weed in all wetlands, it is less of a problem where the water table is maintained at a natural level. Gorse can potentially change the nature of the low nutrient peat bog systems because, being a nitrogen fixer, it adds nitrogen to the soil through litter breakdown. Increased nutrient levels may result in the low-nutrient adapted native plant species being out-competed by more aggressive nutrient-demanding species.

Other important weeds include the trees, silver birch, and service berry, which thrive in the low nutrient, acid soils, and are encroaching from the margins in towards the centre of some peat bogs (e.g., Hudson's). Weeds that are mainly confined to marginal or disturbed areas of wetlands include blackberry, rowan, Yorkshire fog, and other pasture herbs and grasses. Pine invasion may also be an issue in minerotrophic wetlands that are adjacent to seeding pine plantations.

Two notable serious weeds of Waikato wetlands that are not yet a problem in Southland are grey willow and blueberry. Grey willow is a deciduous small tree that produces abundant, wind-dispersed seeds that can germinate while floating on water. Once established, it can spread rapidly and dominate both minerotrophic and shallow peat systems, overtopping and displacing native plant communities, thus completely altering wetland structure and function. It has the potential to become a real threat in Southland wetlands and therefore any infestations should be removed as quickly as possible. The recent horticultural development of blueberry farming on peatland (e.g., Bayswater) introduces the threat of blueberries naturalising in undeveloped peat bogs nearby. Blueberry is native to northern hemisphere peatlands and its seeds are readily spread by fruit-eating birds. In the Waikato, wilding blueberries have established in peat systems in the vicinity of blueberry farms.

Nutrient enrichment

This is mainly an issue where intensive land use practices exist upstream of minerotrophic wetlands. With the increased pressure to develop dairy farms in Southland, this was identified as a key risk.

While nutrient enrichment is less of a threat to peat systems because by definition they are more hydrologically isolated from their surroundings, there is still the potential for fertiliser drift from adjacent farmland. In addition, drainage and oxidation cause peat to degrade and release nutrients that were unavailable under the formerly anaerobic conditions. The effects of introduced nitrogen-fixing plants, such as gorse, on raising soil fertility have already been noted in the previous section.

Hard edges

The abrupt transition from farmland to wetland is an issue, not just because of the impacts of drainage on peat, but because of the loss of natural buffer zones and complete vegetation sequences. We saw very few examples where the natural sequences from forest to bog are intact, or where wetlands do not have abrupt artificial boundaries.

Wetland size

Many wetlands we visited were relatively small, either because they were isolated peat domes, or they are remnants of much larger systems. On average the Southland raised bogs are smaller than equivalent systems in the Waikato, another aspect to their uniqueness. Small size can be a problem from a preservation/restoration perspective, however, because the edges, where weed invasion, water table lowering and fertiliser drift all have their greatest impact, constitute a much larger proportion of the overall area of the wetland. This is also a very significant factor for valley-bottom minerotrophic systems where most of the wetland is closely adjacent to farmland.

Landuse change

This includes the drainage and modification of wetland soils for traditional agriculture, as well as more recent trends towards blueberry farming and deer farming. Increased pressures and threats exist now because of higher land prices and returns achievable from dairy and deer farming.

Peat mining

We visited a large peat mine at Tussock Creek, close to Invercargill. While extremely valuable, peat is also a non-renewable resource, certainly in a human timeframe. We felt that mining should be subject to the strict requirement that restoration of peat-forming vegetation be established once peat has been harvested. Techniques that have been successfully applied for restoration of mined peat surfaces in Waikato, could be trialed and adapted to Southland conditions (e.g., Schipper et al 2002).

Peat harvesting should be followed by restoration of peat-forming vegetation and hydrology.

Fire

Fire (caused by lightning strike etc.) has always been a natural phenomenon in peatlands and the system usually recovers relatively rapidly provided suitable seed sources are nearby. Over the history of human occupation fire frequency has significantly increased and this has undoubtedly played a major role in wetland transformation and loss of some important vegetation associations such as bog-pine communities. While the frequency has probably declined in recent decades, over-drainage of peat presents a significant fire risk, and fires can be especially damaging where they burn deep into over drained peat.

Grazing

All efforts should be taken to keep stock out of wetlands and wetland margins.

Drainage caused by stock trampling and browsing is evident in unprotected wetlands that are inadequately (or not) fenced. Wetlands are fragile systems and recover from stock damage very slowly. Besides physically pugging and compacting the substrate, and eating foliage and shoots, stock also add nutrients and seeds of introduced species through their excrement or urine.

Figure 2 Fencing to keep stock out of drains and wetland margins. *Photo: Dave Campbell.*

Representativeness of remaining wetlands

While all wetland types are poorly represented in Southland Plains Ecological District compared to their former extent, swamps are probably the least well represented (expanded in Clarkson 2002). There is a strong case to be made

for preserving much of what remains based on the need to have adequate examples of wetlands ranging from estuarine to upland raised bogs.

Lack of knowledge

There are several issues here. Landowners and communities are less likely to value wetlands when they have little knowledge of their natural values and the services they provide. Regional and district councils can play a key role here in providing education materials. There is generally poor understanding of the different types of wetlands and the flora and fauna they support. The identification of key sites for interpretive boardwalks and trails, such as the Awarua Plains blanket peatland accessible from the Tiwai Peninsula road, would serve an invaluable role as an educational opportunity and as a drawcard for tourists.

Develop educational materials.

Identify key sites for interpretive boardwalks and trails.

In a different context, we have a very poor understanding of what Southland's wetlands were once like. It is obvious that some very significant plant associations have been lost, largely due to agricultural development or modification by fire, but we do not know what we should be aiming for with restoration in many cases. For example, restoration of tall manuka stands in Awarua Bog, which in 1865 was mapped as swamp forest, needs to be guided by palaeoecological studies (pollen and macrofossils) on what the main species were. Elsewhere, it is apparent that in many cases the key peat-forming species have changed, typically *Sphagnum* has been replaced by wire rush under drying conditions.

Monitoring to measure progress in achieving restoration goals and to understand wetland functioning.

We have a poor knowledge of the risks faced by wetlands, such as the rate of invasion of key weed species, or the extent of influence of deep drains.

The hydrological functioning of various types of wetlands is still poorly understood. Some wetlands are more resistant to damage by water table lowering than others. In order to carry out restoration successfully, an understanding of the hydrology of intact systems of a similar type is required. Monitoring of hydrological and ecosystem functions prior to, during, and following restoration activities is necessary to aid in ongoing maintenance and further restoration efforts and to measure progress in achieving restoration goals.

Empodisma die-back

We observed some severe cases of wire rush die-back, notably at Centreburn, Dunearn (Figure 3), and Taramoa. We could only speculate on the causes of this phenomenon, but it is unlikely to be due solely to a lowered water table. An interaction between water table depth and severe freezing events is one contender, but this illustrates a serious knowledge gap.

Figure 3 Empodisma die-back at Dunearn. Photo: Dave Campbell.

Lack of statutory protection

Few wetlands enjoy formal protection status and thus face the risk of future drainage and development. The large Awarua Plains/Seaward Moss wetland complex is only partially protected, yet this is a wetland of undoubtedly international significance, with real development pressures beginning to impact on its margins.

Incorporate wetland protection into regional and district plans.

Wetlands in Southland warrant the level of protection provided in Section 6(a)of the Resource Management Act (1991), i.e., “the preservation of the natural character of …wetlands… and the protection of them from inappropriate subdivision, use, and development”. It is essential that district and regional councils recognise their values and importance and build their protection into relevant formal plans.

4. Directions for the future

Future directions for wetland protection, management, restoration and prioritization in Southland should be based on existing frameworks for assessing wetland significance in the context of the Resource Management Act (1991) (Whaley et al. 1995). A report on assessment criteria and how to apply them for Southland Plains Ecological District has been recently produced (Clarkson 2002). The most important criterion is representativeness, i.e., how representative are the present wetland types, extent and quality, compared to what existed in the past. Priorities should be determined according to which wetland systems have suffered the greatest losses and which are most poorly represented in the reserves network. Research priorities should involve gaining more knowledge of wetland functioning; species: environment models, hydrology, weed ecology, and restoration at both the species scale (e.g., the threatened *Donatia* cushion bog communities at Waituna) and whole catchment scale (e.g., Big Lagoon).

Develop priorities for wetland protection and restoration.

Restoration of some wetland systems is underway, notably with ongoing efforts at Dunearn bog (Figure 1). This project is a very significant one, both in a regional and a national context. It is critical that we gain knowledge from the experience, via ongoing monitoring of the hydrology and changes to vegetation following the blocking of drains.

Educational materials, along the lines of those produced by Environment Waikato, could be used to raise awareness amongst landowners and the public. It will take time to change the perception of "wetlands as wastelands" into "wetlands as natural treasures", but education is the only sure way of achieving this.

Education to raise awareness of wetland values.

We identified the blanket peatlands along the Tiwai Peninsula road as a key site for an interpretive trail that could act as a focus for education and as a tourist attraction. Here, proximity to Invercargill along a tourist route, existing parking, and easy access into a relatively pristine peatland ecosystem offer exciting possibilities, provided adequate funding can be obtained to build a boardwalk and interpretive signs.

5. Acknowledgements

We thank Eric Edwards and Brian Rance from DOC Southland for organizing a stimulating week of fieldtrips and workshops to some of the wonderful wild places in the Southland Plains region. We thank the Edwards and Rance families, and Carol West, for their wonderful Southland hospitality.

Nature Heritage Fund, Department of Conservation, Environment Southland and Southland District Council provided funding which made our visit to Southland possible. The wetlands research was partly funded by the Foundation for Research, Science and Technology (Contract C09X0205).

Annie Perkins of Groundwork Associates facilitated two days of workshops that highlighted the key messages arising from consultation with the range of organisations and individuals who care about Southland's wetlands.

6. References

Clarkson, B.R. 2002: Assessment of significance of peatlands in Southland Plains Ecological District. *Landcare Research Contract Report* to Department of Conservation, Southland. 14pp.

Department of Conservation and Environment Southland, 2003. *Issues for Southland's wetlands: the stewardship of our lowland peatlands and swamps.* Unpublished summary of key outcomes from a field day and workshop for community groups, 16 and 17 January 2003.

Environment Waikato; Peat Management Advisory Group 1999: For peat's sake: good management practices for Waikato peat farmers. Environment Waikato, Hamilton.

Schipper, L.A., B.R. Clarkson, M. Vojvodic-Vukovic. R. Webster. 2002. Restoring cut-over peat bogs: a factorial experiment of nutrients, seeds and cultivation. *Ecological Engineering* **19**: 29-44.

Whaley, K.J.; Clarkson, B.D.; Leathwick, J.R. 1995: Assessment of criteria used to determine 'significance' of natural areas in relation to section 6(c) of the Resource Management Act (1991). *Landcare Research Contract Report LC9596/021* to Environment Waikato. 34 pp.

Appendix

Southland wetland workshop outcomes.

These worksheets were the result of site visits in January 2003, and list, for each wetland visited; key positive and negative factors, as well as key recommendations.

Seaward Moss
Awarua Plains Complex

Positives	Negatives
Research potential	Local extinctions
Intact sequences	Missing edges
Large size	Continued development
Best blanket peat	Effluent/nutrients
Internationally significant	Fragmentation
General diversity	Lack of interpretation
Landscape values	Only 25% protected
Iwi values	
Healthy peat system	
Relatively weed-free	
Landcare group	
Massive carbon sink	

Recommendations

- Eco-tourism opportunities – interpretation
- RAMSAR status
- More legal protection

Note: Site inspection undertaken on Monday 13th and as part of workshop fieldtrip on Thursday 16th January 2003.

Waituna Cushion Bogs

Positives	Negatives
Largest area of Donatia cushions	Long history of grazing and fire
Unique system	Being out competed/overgrown
Other alpine species	Potential for weed establishment
Good access	
Potential for interpretation	
Tourist attraction	

Recommendations

- Research on restoration/management options
- Treatment and control experiments

Note: Site inspection undertaken on Monday 13th January 2003.

Taramoa Raised Bog

Positives	Negatives
Healthy peat	Edge peat decomposition
No internal drains?	Weeds (gorse)
Close/closest to Invercargill	Wire rush dieback
Plant sequences	Deep ring drains
60-70 ha	Relatively small (c.60ha) therefore prone to modification/threats
Carbon sink	

Recommendations

- Infill drains?
- Weed control
- Monitoring condition – great opportunity
- Ensure protection

Note: Site inspection undertaken on Tuesday 14th and as part of workshop fieldtrip on Thursday 16th January 2003.

Dunearn Bog

Positives	Negatives
Has protection status	Loss of much of system
60 ha	Deep internal and external drains
Keystone species present	Peat degradation
Good relations with neighbouring farmers	Dieback of wire rush
Weed free	Reserve design poor ➢ excluded flax margin ➢ excluded part of dome ➢ excluded external drain
Restoration example	
Research potential	

Recommendations

- Fill/block internal drains
- Investigate modifying external drains
- Monitor recovery – hydrology/peat/vegetation

Note: Site inspection undertaken on Wednesday 15th January 2003.

Hudson Bogs

Positives	Negatives
No centre drains	Weeds extent (silver birch, cranberry sp, gorse, rowan, blackberry) $$$ needed to control
Intact peat	Lack of legal protection
Hydrology	Cost of weed control
Bog pine wood	
Skinks	
Diversity	
Potential for sequence preservation	
Positive landowner	

Recommendations

- Weed Control
- Identify Weeds

Note: Site inspection undertaken on Wednesday 15th January 2003.

Centreburn

Positives	Negatives
Soft edges	Peat degradation
Vegetation diversity	Centre drains
Fish habitat	Wire rush die back
Bog pine	
Relatively weed-free	
Turf-moss mires	

Recommendations

- **Fill/block drains**
- **Monitor recovery**

Note: Site inspection undertaken on Wednesday 15th January 2003.

Tussock Creek Mine Site

Positives	Negatives
Peat base remains	Lack of restoration objectives
Local seed sources	Unsustainable
Economic resource	Exploitation
Close to Invercargill	Non-renewable
	Air quality hazard
	Privately owned

Recommendations

- Restoration model site
- Consult with owners
- Check company vision statements

Note: A roadside inspection and discussion was held as part of the workshop fieldtrip on Thursday 16th January 2003.

College Stream Swamp

Positives	Negatives
Sequences	Small compared to what was there
Largest remaining	Dairy effluent
Cultural values – Iwi	Weeds (diversity)
Recreational – duck hunting	Drainage changes
Minor weed	Loss of adjoining original vegetation
Active weed control	Poorly known (hidden)
Valley bottom system	
Nutrient stripping	
Protection underway	
Educational & research potential	
Fish habitat	

Recommendations

- Remove pines
- Investigate restoring natural drainage
- Restore shrub/forest buffers

Note: Site inspection undertaken on Tuesday 14th and as part of workshop fieldtrip on Thursday 16th January 2003.

Big Lagoon

Positives	Negatives
Wide support for restoration	Large project $$$
Important wildlife habitat	Vision unclear
Protection ensured?	Loss of size
Remnant vegetation sequences	Major modification
	Un-natural outflow
	Weeds
	Surrounding farming operations

Recommendations

- Involve neighbours
- Ecosystem vision rather than just recreational/habitat
- Surveying for depths, edges
- Base-line inventory – plants – animals – soils?

Note: Site inspection undertaken on Tuesday 14th January 2003.

Turnbull Oxbow/Floodplains

Positives	Negatives
Morning tea!	Loss of natural flooding regime
Visionary landowner	Forest condition through 1996 die back
Reserve (QEII) status	Weeds (Elderberry, hawthorn, willow, bittersweet, Chilean flame-creeper ….)
Neighbouring DoC reserve	Fragmented
~60ha – largest remaining	
National significance of Divaricated species	
Sequence "intact"	
Interpretation track	
Agency support	

Recommendations

- Restoration planting – Matai regeneration (acid litter)
- Reinstate flooding
- Control weeds
- Monitoring regeneration of threatened species

Note: Site inspection undertaken on Sunday 12th January 2003.

Lake Cook

Positives	Negatives
Excellent example of a coastal lake	Outlet channel modified
Important wildlife habitat	Hard edges with pasture
Good example of rare community (ie flax swamp)	Loss of size (original extent about twice the size)
Relatively intact	Not well fenced
Sympathetic landowner	
Relatively weed free	

Recommendations

- Legal protection
- Fencing
- Weed control

Note: Site inspection undertaken on Monday 14th January 2003.

Bushy Point estuary edge sequence

Positives	Negatives
Intact vegetation sequence from forest to estuarine mudflats	None
Boardwalk/interpretation track	
Visionary landowner	
Protection (QEII covenant)	
Threatened plants present	
Fernbirds present	
Neighbouring DoC reserve	
Restoration planting underway	

Recommendations
➢

Note: Site inspection undertaken on Friday 10th January 2003.

Motu Bush/Mouat swamp/forest complex

Positives	Negatives
Intact vegetation sequences from tall podocarp forest through shrubby swamp forest into swamp	System only partially protected
Threatened plant populations (13 species recorded)	Loss of linkage with the peatland
Good example of rare lowland forest and wetland communities	Stock access and modification of the forest edge
High diversity of plants (notable threatened plants and divaricating plants) and communities	Poor recognition of the importance/significance of the site
Viable size of the area	
Weed free	
Interested landowners	
Research underway at the site	

Recommendations

- Implement legal Protection
- Restoration planting along forest edge
- Undertake fencing to exclude stock
- Monitoring regeneration of threatened species

Note: Site inspection undertaken on Saturday 11th January 2003.

Mouat/New Zealand Deer Farms wetland

Positives	Negatives
Relatively large size (c. 125 ha)	Hard edges around much of the boundary
Vegetation diversity (includes wire-rushland, flax swamp, manuka shrubland, lagg swamp areas)	Marginal drains
Intact condition with few internal drains	Evidence of Sphagnum harvesting
Presence of bog pine and pygmy pine	
Relatively weed-free	
Good peat condition	
Potential sequence onto adjacent terrace slope (beech forest)	

Recommendations
➢ Fill/block drains ➢ Legal protection

Note: Site inspection undertaken on Saturday 11th January 2003.
nuary 2003.

Bayswater Bog

Positives	Negatives
Large size (c. 800ha + 200ha)	Most of the wetland unprotected
Diversity of vegetation/habitat, contains a springs with gully, ponds etc	Development of part of the system into a blueberry farm
A portion of the lagg wetland margin with flax swamp survives	Deep external drains
Few internal drains present	Weeds scattered through wetland interior (includes gorse, silver birch and eucalyptus)
Research potential	Fire history has modified the vegetation
Deep peat (c. 8 m?)	Hard edges with pasture

Recommendations

- Legal protection of addition parts of the system (esp. NW portion and lagg wetland)
- Weed control
- Monitor impacts of the blueberry farming operation

Note: Aerial overview undertaken on Wednesday 15th January 2003.

Castle Downs Bog

Positives	Negatives
Large size (c. 1000ha)	Much of the wetland unprotected
Diversity of vegetation/habitat, contains a springs with gully, ponds etc	Internal and external drains
Partially protected	Fire history has modified the vegetation, reducing woody vegetation
Few weeds	Hard edges with pasture
Abundance of red tussock	
Research potential	

Recommendations
➢ Legal protection of additional parts of the system ➢ Divert and block the internal drain

Note: Aerial overview undertaken on Wednesday 15th January 2003.

Waipapa Beach dune slack/turf system

Positives	Negatives
Large size of dune slack/turfs (largest in Southland)	Weeds (gorse, tree lupin)
Diversity of communities and plant species	Stabilisation of the system (increases in exotic rushes, grasses and herbs)
Water table variations – ephemeral wetlands/ponds	Stock grazing
Crown owned	Poor recognition of the importance/significance of the site

Recommendations

- Restoration of adjacent dune communities
- Weed control
- Involve neighbours

Note: Site inspection undertaken on Tuesday 14th January 2003.