

POTENTIAL DIRECT EFFECTS ON BIOSECURITY FROM SUBDIVISION DEVELOPMENT ACTIVITIES

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Activities directly associated with subdivision development have adverse effects on biosecurity in New Zealand. The Resource Management Act (1991), Biosecurity Act (1993) and the Biosecurity Strategy (2003) all require necessary steps to be taken to avoid and/or mitigate the adverse effects on the environment and the establishment and spread of invasive species within New Zealand. This article raises the point that appropriate new biosecurity measures will need to be considered and mainstreamed into urban and rural subdivision planning to avoid, mitigate and remediate the adverse effects of subdivision development on biosecurity. Such initiatives are already being adopted in parts of Australia and the USA which can provide useful guidance.

Regulatory control is likely to be most appropriate on new development sites where high risk weed species have been identified as a direct result of development activities. Such measures are needed to pre-empt the development of new 'satellite' populations of low-incidence-high risk species, even if the development site under consideration is not in the neighbourhood of significant ecological sites or sensitive landscapes.

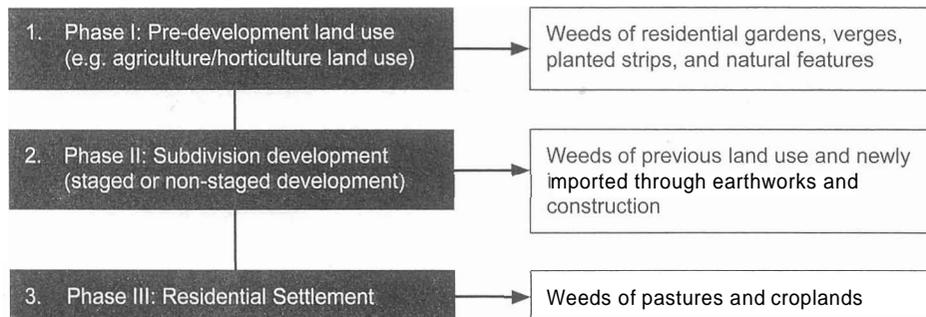


Figure 1 Phases of the subdivision development relevant to weed establishment and spread.

Risk Pathways Associated with Subdivision Development Activities

Several risk routes have been identified in weed establishment and spread. Figure 1 highlights the major phases of the subdivision development process that have direct impact on weed establishment and spread at the landscape-level.

Weed propagule (parts of the weed plants that can reproduce) sources on subdivision development sites can be generalised as follows: In situ weed seed banks or plant fragments from previous land use. Ex-situ imported propagules through contaminated vehicles and machinery.

Earthworks

Earthworks are major land and soil disturbing activities occurring at varying scales within the landscape, depending on the scale of development activities. Short to medium-term sites of stockpiled and exposed topsoil, on disturbed land, acts as pseudo-colonising substrate, where generalist pest plant species are likely to emerge or colonise from the local weed seed bank in the stripped topsoil.

Seeds or plant stem/root fragments capable of reproducing are mobilized (imported and exported) from development sites via vehicles, machinery and other equipment (contaminated goods). The size of the development project,

intensity of vehicle traffic (and history of contaminated goods) is likely to influence the level of risk exposure.

Inter-district/regional transport of risk pest plant species associated with these contaminated goods act as dispersal agents to accelerate spread on noxious species beyond natural spread rates.

Earthworks and landscaping activities that require the importing of topsoil from other locations may cause incidental/accidental spread of potentially contaminated soil. Currently there is insufficient source/origin information to assist end-users of the soil material in assessing if the soil is likely to be contaminated, in particular with propagules of known noxious weeds.

Greenwaste Disposal

As a part of vegetation clearance on the site, contaminated greenwaste (containing weeds and their propagules) if not appropriately contained and disposed of off-site in greenwaste/organic refuse facilities at any stage of the development process, can lead to re-establishment of weed species. This is especially important in subdivisions which are in proximity to ecological sites of significance or other ecologically valuable areas that are vulnerable to pest plant invasion'.

Newly re-vegetated/restored areas

Under RMA soil stabilization requirements in subdivision development sites, areas such as steep undeveloped escarpments are likely to require re-vegetation/restoration. Areas such these, or gully corridors may receive less weed management attention in the long-term, due to potential to be less accessible, and risk gradually becoming new 'safe sites' for weed establishment themselves. Serious weed infestations have been reported on esplanades that are with associated subdivisions. Native vegetation on steep escarpments, nestled in undulating terrain near residential areas,

is often a safe site for multiple weed species establishment in the absence of adequate weed control measures.

Landscape-level linkages to subdivision development

Important linkages exist at the landscape-level between expanding subdivision development and other natural/physical features of the landscape such as bush remnants, riparian strips, reserves, esplanades, gullies, and coastal wetlands. Associated infrastructure gains such as roads and stormwater channels produce new access and distribution corridors for weed propagules to be transported by people or water respectively. Streams and rivers at the wider landscape-level provide routes of dispersal carrying weed propagules downstream and creating potential new satellite populations/infestations (King and Buckney, 2000). This is further exacerbated once residential settlement occurs and residents establish planted gardens which are potential habitat and sources of multiple weed species and garden escapes over longer time scales (Sullivan et al. 2004; McKinney, 2002). The lag periods before ornamental species emerge as invasive weeds, often delay response strategies to control their spread.

Development activities (both for construction of new residential areas and other agrarian activities) infringe increasingly on the fragile/unstable edges of remnants scattered in the landscape, which are often prone to greenwaste disposal once settlement period begins.

The region also needs to protect important natural areas and features as listed in the District/Regional Plans and managing subdivision development within 'sensitive landscape areas'. Stringent measures to avoid the introduction of new weed species through development activities must be exercised for development in the neighbourhood of such features/landscapes.

Towards measures for avoiding, mitigating adverse effects of development activities

In the absence of appropriate weed hygiene measures, contamination of new sites by known/emerging weeds is inevitable. Therefore, some possible measures are presented here, which may be further explored to suit the New Zealand context.

Earthworks

The main aims of any new measures should be mainly to:

- pre-empt the introduction of new weeds to new development sites
 - eradicate low incidence/high risk pest plant species, which are forming satellite populations on development sites.
- Surveillance/monitoring of sites after control/eradication will be necessary once the control work has been completed.

Incorporation of targeted biosecurity control measures can be integrated into the 'Structure Plans' prepared for new subdivisions or other developments. Linkages need to be made to 'site rehabilitation' where known and listed noxious weeds have been introduced, and where eradication and control measures must be taken before the end of development work, involving all exacerbators.

Appropriate weed hygiene measures can be mainstreamed and applied to the building and construction industry for movement of vehicles, machinery, and equipment for treatment, control of contaminated things (contaminated with weed reproductive propagules).

Mainstreaming appropriate weed hygiene measures on development sites could include such requirements as:

A written declaration or its equivalent (similar to the 'Weed Hygiene Declaration' used by the Natural Resources and Mines, Queensland, Australia) including disclosure of such information as:

points of origin of the materials and whether at the origin points there have been any

known infestations of high risk weeds (species list must be included for guidance). If the goods come from contaminated points of origin, then require risk avoidance measures/mitigatory measures e.g. washing/cleaning, quarantine period, chemical treatment, certified clean.

vehicle/equipment/machinery movement must include information such as make/model/registration number and whether the vehicle/equipment/machinery was cleaned prior to entry onto the development site.

- any material that is /likely to be contaminated by weed propagules and the measures being taken to contain the propagules and avoid further contamination during transport, including such measures as covering with material such as tarpaulin, enclosing materials in a container, chemical (or other appropriate) treatment.

Washdown sites on subdivision

development sites with known noxious weed species with further in-situ contained weed control to kill weedy propagules (for weedy species spread by vegetative means). Unlike on farming properties, these clean-down/wash-down sites will have to be temporary areas/facilities that cater to the nature/lifespan of the development site. On-site effluent treatment from wash-down/clean-down of machinery and vehicles and waterway contamination – ensure propagules are not flushed into local waterways that can later re-infest or create new satellite populations down stream particularly if in an ecologically sensitive area with naturally significant areas or features that need to be protected. Bunded sediment traps may be used for this purpose.

Possibility of incorporating the need for weed hygiene requirements with 'Performance 1 monetary bonds' under subdivision development regulations to ensure the undertaking and completion of weed control of identified high risk weed species before the termination of development work. Targeted local biosecurity

rates for specific post-development ongoing eradication/control measures associated with the development (particularly in high risk sites affected by high risk weeds – considered contaminated). This can be implemented through 'Declaration of restricted place and Declaration of controlled area' provisions in the Biosecurity Act 1993 and providing 'Power of inspection' to biosecurity officers.

1. Ruderal site management of stripped earthheaps by covering (weed matting/cloth) as a first measure to inhibit/control weed emergence from the soil seed bank of high-risk weeds or in high priority landscapes. This could curb flowering and seed formation in topsoil that is known/likely to be infested with weedy propagules that will re-invade sites. Topsoil stripping and reapplication on construction sites means retention of the in situ soil seed bank of weed species.
2. Earthworks need to be accompanied with stormwater and sediment control measures (including re-vegetation), to reduce sedimentation (and transport of weed propagules) and nutrification of natural and man-made waterways which degrade riparian margins (and others) and enhance their suitability for weed establishment.
3. Grassing of undeveloped strips where bare ground over the development period, is likely to facilitate the establishment of weed populations (in particular high risk species). This may also act as grass filter strips in controlling sediment runoff with stormwater.
4. Site inspections are required to be undertaken by biosecurity staff for the purposes of pre-development weed inventories, weed contamination surveys at various stages of the development phase and for the inspecting washdown procedures, washdown effluent management, ruderal site management (weed matting where seen as a necessary measure), and the effectiveness of eradication, control, containment, surveillance, monitoring activities.
5. Requre coordination on the part of biosecurity

personnel, developers and contractors and city planners to redesign development practices to incorporate weed hygiene aspects into planning, regulation and implementation.

Newly re-vegetated sites

Weed control measures must accompany all re-planting activities, e.g. on esplanade reserves or marginal strips, beyond the lifetime of the development (transfer of responsibility to councils after development term).

Conclusion

Regional Councils in New Zealand recognize the importance of subdivision development as a risk route for the spread and new infestation of weed species which increase the burden on regional biosecurity. There is a growing need to develop a coordinated approach to manage these risks more effectively. Initial consultations and further exploration of the risk pathways, and appropriate policy and regulatory interventions to avoid and mitigate against adverse impacts need to be considered with relevant stakeholders to inform and guide the process.

Acknowledgement

This is part of work undertaken for Environment Waikato Regional Council under contract number 1024617. The guidance of Dr. David Stephens (Environment Waikato), who commissioned the work, is greatly appreciated. My sincere thanks also to Associate Prof Richard Warrick, Dr Peter Ulrich, Prof Neil Ericksen, Claire Gibson and Greg Mason (IGCI, University of Waikato) for reading and editing the original drafts.

References

Agricultural Contractors of Tasmania, Inc.
 Agricultural Contractors of Tasmania Incorporated:
Code of Practice Draft 04/03. Available at:
[http://www.dpiwe.tas.gov.au/inter.nsf/Attachments/\\$LEN-5NV5DY/\\$FILE/Codes%20of%20Practice%20-%20Tas%20Agric%20Contractors.pdf](http://www.dpiwe.tas.gov.au/inter.nsf/Attachments/$LEN-5NV5DY/$FILE/Codes%20of%20Practice%20-%20Tas%20Agric%20Contractors.pdf)

Table 1: Subdivision Types, Land Use Transitions and Likely Biosecurity Risks

Subdivision/residential development type		Land Use Transition (LUT)	Likely Biosecurity Risks (Pest Plants)
Major residential/industrial development	greenfield sites mostly in peri-urban areas	Agricultural/horticultural to new residential	Agricultural/horticultural weed stock likely
	coastal (e.g. linear 'ribbon' development)	Agricultural/horticultural to residential	Agricultural/horticultural weed stock likely. Sites likely to be more affected by wind dispersal in coastal locations
	other new settlements		
Infill/Brownfield development	urban renewal/densification through new residential lots on existing residential properties	Urban to urban	Urban weeds- i.e. more environmental weeds likely Minor effects in isolation on individual lots, but may contribute to cumulative effects that require policy on natural character and amenity values
	Redevelopment of previous (e.g. industrial) sites		
New rural residential development	e.g. life-style blocks	Agricultural/horticultural to new residential	Agricultural/horticultural weed stock likely
Subdivision within sensitive landscapes	Outstanding natural landscape or feature		
	Within coastal/riparian margins		

Department of Primary Industries, Water and Environment, Forestry Tasmania and the Agricultural Contractors Association of Tasmania. *Tasmanian Washdown Guidelines for Weed and Disease Control*. Edition 1, April 2004. Available at: [http://www.dpiwe.tas.gov.au/inter.nsf/Attachments/LJEM-5ZM43C/\\$FILE/Washdown%20Guidelines%20Edition%201.pdf](http://www.dpiwe.tas.gov.au/inter.nsf/Attachments/LJEM-5ZM43C/$FILE/Washdown%20Guidelines%20Edition%201.pdf)

Biosecurity Act 1993 (Reprint as at 30 May 2005) 012.5: Pest Management Section 80B: Strategy rules.

Environmental Protection Authority (2004). *Handbook for Pollution Avoidance on Building Sites – Second Edition*. Environmental Protection Authority, Adelaide. Available at: http://www.epa.sa.gov.au/pdfs/building_sites.pdf#search='australia%20washdown%20requirements%20in%20earthworks'

Lee, W.G., Williams, P, and Cameron, E. (2000).

Plant Invasions in Urban Environments: The Key to Limiting New Weeds in New Zealand. In: Suckling, D.M., and Stevens, P.S. (Eds.). *Managing Urban Weeds and Pests*. Lincoln, Canterbury: New Zealand Plant Protection Society. Ministry for the Environment (2002). *The New Zealand Zero Waste Strategy: Towards Zero Waste and a Sustainable New Zealand*. Wellington. Mooney, H.A. and Hobbs, R.J. (Eds.) (2000). *Invasive Species in a Changing World*. Island Press: Washington, D.C.

Natural Resources and Mines, Queensland Government. (2003). *Weed Hygiene Declaration*. Queensland. Available at: http://www.nrm.qld.gov.au/pests/weeds/weed_spread/pdf/weed_hygiene_dec.pdf#search='weed%20hygiene%20declaration%20queensland'

Quality Planning. *Quality Planning – The RMA Planning Resource*. <http://www.qp.org.nz>

Radosovich, S, Holt, J., and Ghersa, C. (1997).

Weed Ecology: Implications for Management. 2nd Edition. John Wiley & Sons, Inc.: New York.

Resource Management Act (1992). Sullivan, J.J., Timmins, S.M, and Williams, P.A. (2005). Movement of exotic plants into coastal native forests from gardens in northern New Zealand. *New Zealand Journal of Ecology* 29(1): 00-00 (In press).

Sullivan, J.J., Williams, P.A.; Cameron, E.K. and Timmins, S. (2004). People and Time Explain the Distribution of Naturalized Plants in New Zealand. *Weed Technology* Vol. 18: 1330-1333.

Footnote

1. i.e. having higher potential invisibility risk of the area due to factors such as proximity, size, shape, local disturbance regimes, access points, and edge effects such as altered light and nutrient levels from surrounding land uses.