

SUMMARY REPORT

Feasibility of Targeted Invasive Plant Grazing In Metro Vancouver



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EXECUTIVE SUMMARY

This report assesses the feasibility of targeted invasive plant grazing in Metro Vancouver, reviewing the efficacy, challenges, and considerations of targeted grazing treatments for control of invasive plants. Fourteen targeted grazing practitioners were interviewed to assess the operational feasibility of targeted grazing treatments. Seven suitable species were selected, and a review of available literature and data enabled detailed assessments of targeted grazing versus other control treatments, comparing efficacy and costs. Recommended approaches were provided for effective control of each suitable invasive plant species. Generally, control treatments must be repeated and used in combination with other complimentary methods. Additionally, monitoring and follow-up action plans are needed to prevent recolonization, in conjunction with effective restoration/revegetation plans to re-establish competitive native communities.

The efficacy of targeted grazing was determined for seven target species:

Invasive Species	Control Efficacy
Giant Hogweed	High
English and Irish Ivies	High
Himalayan Balsam	High
Wild Chervil	Moderate-High
Himalayan Blackberry	Moderate
Scotch Broom	Moderate
Purple Loosestrife	Low-Moderate

Targeted grazing treatment application costs were found to be comparable to mowing and manual control efforts; however, additional costs may be associated with logistical requirements necessary to enable targeted grazing. These costs are difficult to quantify, highly variable, and site specific.

Significant logistical considerations must be addressed prior to implementing targeted grazing treatments, ranging from addressing legal requirements, public communication, partnerships with bylaw enforcement agencies and police, animal husbandry requirements, biosecurity considerations, provision of pre-grazing data, post-grazing monitoring, and effective restoration. Adequate funding and staff resources must be in place to support all the logistical considerations. If treatments are applied ad-hoc and do not meet the recommended timing, frequency, and duration, control will be ineffective.

Goats are suggested as the most suitable livestock (versus sheep, pigs, or cows) to perform targeted grazing based on efficacy, ease of handling, public perception, and availability of herds. There is a shortage of targeted grazing practitioners in Western Canada and none in the Lower Mainland, but five practitioners expressed interest and willingness to work in the Metro Vancouver Region.

Potential carbon implications were reviewed as part of a case study for targeted grazing of Himalayan blackberry at Metro Vancouver's Aldergrove Regional Park finding that emissions from targeted grazing would be lower than burning, but higher than mowing or manual control.

A 3-5 year operational grazing plan, field testing recommendations, and monitoring protocols were provided. Specific cost estimates for targeted grazing at Aldergrove Regional Park range from \$12,000-\$56,000 per year based on a combination of practitioner interviews and recommended frequency and duration requirements from literature review. Subsequent interviews with 'willing to travel' practitioners and the need for a part-time coordinator conclude that a realistic annual budget should be \$40,000 for a grazing practitioner and \$30,000/year for a part-time coordinator.

Targeted grazing treatments in Metro Vancouver are only feasible if logistical considerations can be met, and funding and staff resources have been allocated to support the long-term partnerships necessary for effective control. If treatments are applied ad-hoc and do not meet the recommended timing, frequency, and duration, control will be ineffective.

If Metro Vancouver decides to proceed with field testing, Aldergrove Regional Park could be a suitable location, with the caveat that logistical considerations must be adequately addressed, and long-term funding must be secured prior to initiating treatments. Success requires implementing long-term treatments focused on consistency in application, monitoring, regrowth management, and restoration.

Goats are suggested as the most suitable livestock (versus sheep, pigs, or cows) to perform targeted grazing based on efficacy, ease of handling, public perception, and availability of herds.

INTRODUCTION

Invasive plants represent a suite of threats to biodiversity, agricultural systems, infrastructure, human health and safety, and recreational values. Targeted grazing could be explored in Metro Vancouver as a potential control treatment, but does include challenges in application and management, and may result in negative unintended consequences if not properly scoped and applied.

Targeted grazing uses the timing, frequency, intensity, and selectivity of grazing/browsing to apply herbivory pressure on specified plant species or sections of the landscape.

Effective targeted grazing treatments requires a knowledge of plant ecology, livestock nutrition, livestock foraging behaviour, livestock handling/management, and site specific ecological attributes.

Targeted grazing is defined as: ‘...the application of a specific kind of livestock at a determined season, duration, and intensity to accomplish defined vegetation or landscape goals.’

METHODOLOGY AND SUITABLE TARGET PLANT SPECIES

A preliminary assessment was undertaken of Metro Vancouver’s 13 priority invasive plant species to determine suitability for control by targeted grazing. Based on a literature review evaluating control efficacy, toxicity, and palatability, the following seven species were deemed as potentially suitable for control by targeted grazing:

- Giant Hogweed
- English and Irish Ivies
- Himalayan Balsam
- Himalayan Blackberry
- Purple Loosestrife
- Scotch Broom
- Wild Chervil

Each suitable plant species was further assessed for digestive efficiency, grazing timing and frequency, treatment duration, and suitable livestock, as summarized in Table 1.

COST AND EFFICACY COMPARISONS

Estimated treatment cost and efficacy comparisons for target plant species were compiled through a literature review, practitioner interviews, and cost data provided by Metro Vancouver. These values are presented in Table 2. Recommendations are based on review of target plant species characteristics, control method efficacy, and estimated costs. Please refer to the recommendation section of the Technical Report for details rationale on treatment recommendations.

Costs of targeted grazing are comparable to most other treatments for the majority of target species. However, overall costs for targeted grazing in Metro Vancouver may be higher due to additional legal and logistical considerations.

TABLE 1. Summary of suitable target plant species assessment.

Target Invasive Plant Species	Efficacy ^a	Palatability	Toxicity	Digestive Efficiency	Grazing Timing and Frequency	Duration (Years) ^c	Livestock Recomm.
Giant Hogweed	High	High	Mild glycosides and flavinoids	Assumed high due to delicate seeds ^b NSSA	2 treatments per growing season: spring and late summer	7	Sheep and goats
English and Irish Ivies	High	High	Mild Contains hederin	Assumed moderate due to hard-coated seeds ^b NSSA	1 treatment per growing season: applied during active growth under dry soil conditions	2	Goats
Himalayan Balsam	High	High	Non-toxic	Assumed high due to delicate seeds ^b NSSA	2 treatments per growing season: spring and late summer	2	Sheep and goats
Himalayan Blackberry	Moderate	High	Non-toxic	Assumed moderate due to hard-coated seeds ^b NSSA	2 treatments per growing season: spring and summer	3-5	Goats
Purple Loosestrife	Low-Moderate	Low Moderately palatable to goats	Non-toxic	Assumed high due to delicate seeds ^b NSSA	1 or more treatments per growing season: applied during active growth	3+	Goats
Scotch Broom	Moderate	Low Palatable to goats	Mild Contains quinolizidine alkaloids, toxicity not reported in goats	Moderate 8% of seeds viable following digestion by goats	1 continuous treatment applied during active growth	4 - 30	Goats
Wild Chervil	Moderate-High	Moderate-High Palatability declines with age	Non-toxic	Assumed high due to delicate seeds ^b NSSA	1 or more treatments per growing season: starting in early spring	2	Goats

^a Efficacy estimates are based on application of recommended grazing timing, frequency, and duration, in combination with ongoing monitoring.

^b NSSA – No Specific Studies Available

^c Duration of active eradication treatments. All treatments require ongoing monitoring past this window and follow-up control efforts when necessary to address any regrowth

TABLE 2. Cost^a per m² and efficacy^b comparisons of treatments on target species. Costs represent a single application and are estimated using best available data from literature, practitioner interviews, and Metro Vancouver.

Target Species	Targeted Grazing ^c	Chemical ^d	Mechanical ^e /Manual ^f	Biological Control	Cultural Control	Treatment Recomm.
Giant Hogweed	\$0.15-\$8.20	\$0.30-\$2	Taproot Cutting \$0.36-\$50	\$ N/A	Fire \$ N/A	Grazing, Chemical, Taproot Cutting, or Hand Pulling
			Hand Pulling \$0.90-\$50			
			Mowing \$0.90-\$13			
English and Irish Ivies	\$0.15-\$2	\$0.30-\$2	Hand Pulling/Cutting \$0.65-\$16	\$ N/A	Fire \$ N/A	Grazing, Hand Pulling/Cutting, or Mulch Application
					Heat Treatment \$ N/A	
					Mulch Application \$N/A	
Himalayan Balsam	\$0.15-\$2	\$0.30-\$18	Mowing \$0.90-\$18	\$ N/A	Fire \$ N/A	Grazing, Chemical, Mowing, or Hand Pulling
			Hand Pulling \$0.90-\$18			
Himalayan Blackberry	\$0.15-\$2	\$0.30-\$2	Hand Pulling \$0.30-\$12	\$ N/A	Fire \$ N/A	Hand Pulling, Grazing, Chemical, Mowing, or Bulldozing
			Mowing \$0.13-\$0.50			
			Bulldozing \$0.30-\$1.22			
Purple Loosestrife	\$0.15-\$2	\$0.30-\$2	Hand Pulling \$0.30-\$12	Neogalerucella beetles \$ N/A	Fire \$ N/A	Biocontrol, Hand Pulling, or Chemical
			Mowing \$0.13-\$0.50		Flooding \$ N/A	
			Hand Cutting \$0.30-\$12			
Scotch Broom	\$0.15-\$2	\$0.03-\$2	Hand Pulling/Cutting \$0.65	\$ N/A	Fire \$ N/A	Hand Pulling/Cutting, Chemical, or Grazing
			Mowing \$0.50-\$2			
			Mulching \$0.07			
			Tilling \$0.10-\$2			
Wild Chervil	\$0.15-\$2	\$4.62	Hand Pulling \$0.30-\$12	\$ N/A	Fire \$ N/A	Grazing, Hand Pulling, Tilling, Mowing, and Smothering
			Tilling \$0.30-\$12		Smothering \$ N/A	
			Mowing \$0.25-\$1			
			Seed Head Clipping \$0.30-\$12			

^a Estimated costs solely reflect treatment costs and do not include other costs that may be necessary to enable treatment application (e.g. logistical and legal considerations).

^b Efficacy estimates based on treatment applied as recommended, in combination with ongoing monitoring and follow up treatments.

^c Grazing treatments may be limited by significant logistical considerations and are not suitable for riparian or wetland ecosystems

^d Chemical treatment is not permitted in riparian and wetland ecosystems

^e Mowing treatment options may not be possible in remote areas and steep slopes

^f Manual removal would be labour intensive for large infestations, but costs may be considerably less if using volunteers

EFFICACY:
High
Moderate-High
Moderate
Low-Moderate
Low

LIVESTOCK SUITABILITY

It is important to match the livestock species with the target plant by taking into consideration grazing preferences, toxicity, and palatability (Olson & Launchbaugh, 2006). For Metro Vancouver, goats are suggested as the most suitable livestock based on efficacy, ease of handling, public perception, and availability of herds.

TABLE 3. Livestock suitability summary.

Livestock Type	Advantages	Disadvantages
Cattle	<ul style="list-style-type: none"> Capacity to ingest large amounts of forage 	<ul style="list-style-type: none"> Select for grasses, avoid shrubs and forbs (invasive plants) More susceptible to toxicity issues
Sheep	<ul style="list-style-type: none"> Adapt feeding habits to available plants 	<ul style="list-style-type: none"> Consume less shrubs and forbs than goats More susceptible to toxicity issues More susceptible to bloat and choke from changes in feed At higher risk for injury and predation
Goats	<ul style="list-style-type: none"> Select for browse and shrubs (invasive plants) Larger range of palatable plants than other livestock Less susceptible to toxicity issues Reduced risk of seed spread due to greater levels of chewing and higher digestive efficiency 	<ul style="list-style-type: none"> Curious and must be monitored closely May girdle off-target trees
Pigs	<ul style="list-style-type: none"> Highly adaptable and will feed on any available forage Will root out plant roots and crowns 	<ul style="list-style-type: none"> Difficult to contain, more likely to escape and become feral Issues with odour and public relations



There is a general shortage of targeted grazing practitioners in Western Canada, and none located in the Lower Mainland. If long-term contract work was available in this region, there may be an opportunity for an emerging local agricultural business.

LEGAL REQUIREMENTS AND LOGISTICAL CONSIDERATIONS

Prior to initiating any targeted grazing projects or engaging in any substantive planning on targeted grazing projects, the parties should ensure that all necessary legal and logistical components (as outlined in Table 4 below) are addressed.

TABLE 4. Logistics checklist for those considering targeted grazing at sites in Metro Vancouver.

Factor	Logistical Consideration(s)	Action(s)
Legal Requirements	Must ensure grazing use is enabled by municipal bylaw(s), obtain business licence, necessary permits	<ol style="list-style-type: none"> 1. Contact municipality 2. Review municipal bylaw 3. Obtain business licence(s) 4. Obtain permit(s)
Grazing Contract	Roles and responsibilities	Determining which party is responsible for which logistical component, including funding
Coordinator	Coordination of various moving parts of treatment is needed to ensure success	Ensure that there is a coordinator available to for contract management, communications, and coordination with partners ^c
Partnership(s)	Proactive communication and partnership building ensures success	Engage with: <ul style="list-style-type: none"> • Police • Bylaw • Community Associations • Adjacent neighbours • BC Society for the Protection of Animals
Communication	Public Education	Encourage support through public engagement efforts such as education days, school visits, citizen science, restoration planting etc.
Base Camp	Must have a base camp area for practitioners to stay on site and monitor livestock 24/7	Ensure that potential targeted grazing treatment sites have areas suitable for base camps Power/water/sewer is not necessary for self-contained units, however spaces must be flat and located relatively near to treatment areas
Animal Husbandry	Shelter	Barns or treed areas must be available to provide a secure bedding area
	Fencing	Portable fencing panels or electric fencing used for night penning and to concentrate use in target areas
	Additional Forage Resources	Allow hay or grazing of non-target plants Ensure hay is weed free to avoid introduction of invasive species
	Poisonous Plants	Obtain permission to scout and remove poisonous plants prior to grazing
	Water	Provide access to on-site water or haul water to site
	Livestock Guardian Dogs	Allow guardian dogs off-leash
	Access	Provide suitable access for long vehicles hauling livestock 24/7 access for practitioners Access to power/water/sewer is not necessary for self-contained units. Restrict public access to grazing sites
	Livestock Management Dogs	Ensure that off leash working dogs are permitted

Factor	Logistical Consideration(s)	Action(s)
Treatment Efficacy	Review efficacy of all treatment options	Ensure funding will support targeted grazing to meet timing, frequency, and duration needs May require a longer-term service contract and resources to write/oversee contract
Pre-Grazing Data	Pre-grazing data is necessary to develop the grazing plan	Provide: <ul style="list-style-type: none"> • Map of target areas, target invasive species, and infestation density • access information • infrastructure information
Site Assessment	Determine site suitability by reviewing criteria	Review site suitability for targeted grazing treatments based on: <ol style="list-style-type: none"> 1. Environmental Suitability 2. Access Suitability 3. Available Infrastructure
Grazing Plan	A grazing plan is needed to implement the grazing treatment	Develop a grazing plan using the variables outlined in Appendix 4
Field Testing	Test grazing efficacy on invasive species	Implement grazing plan and follow-up monitoring to assess success
Biosecurity	Reduce risk of disease	<ul style="list-style-type: none"> • Implement a 'no-touch' policy • Ensure herds are vaccinated and healthy • Use fencing to reduce contact with other livestock • Select for closed herds
Weed Spread	Reduce risk of weed spread	Pen livestock for 3-4 days prior to moving off site
Manure Management	Address manure build up	<ul style="list-style-type: none"> • Develop onsite manure management protocols • Investigate options for offsite manure disposal
Liability Insurance	Practitioners must carry liability insurance	Ensure practitioners carry liability insurance at a rate acceptable to the client
Herd Availability	Limited practitioners	Contact practitioners who have expressed interest
Transportation	No practitioners in the lower mainland	Transportation costs will need to be addressed in the grazing contract
Restoration	Plan for restoration and revegetation plans following weed control	Ensure control does not overwhelm organizational restoration capacity

Costs to address each logistical component in Table 4 may be additional to the estimated treatment costs outlined in Table 2. Identification of roles and responsibilities in the grazing contract, including which party is responsible for funding each logistical component, will be necessary to ensure success.

POTENTIAL CARBON IMPLICATIONS

To investigate the potential carbon implications of targeted grazing treatments relative to chemical, mechanical, and manual control options, Aldergrove Regional Park was used at the control site. Please refer to the Technical Report for more details on the carbon dioxide equivalent emission calculations.

EMISSIONS:

Lowest

Moderate

Highest

TABLE 5. Potential carbon dioxide emission comparisons for each control method for Himalayan blackberry in Aldergrove Regional Park.

Control Method	Emission source	Estimated kg CO2 Emissions (treatment of 4.7 ha)
Targeted Grazing	Transportation	784
	Manure	0
	Generator	0
	Water hauling	0
		784
Chemical	Herbicide use	228
	Transportation	14
		242
Mechanical + Disposal	Mower Equipment	103
	Transportation	14
	Disposal	Landfill = 28 Composting = 22 - 282 Burning = 885
		Landfill = 145 Composting = 139 - 399 Burning = 1,002
Manual + Disposal	Transportation	140
	Disposal	Landfill = 28 Burning = 885 Composting = 22 - 282
		Landfill = 168 Composting = 162 - 422 Burning = 1,025

Carbon dioxide emissions associated with targeted grazing at Aldergrove Regional Park would be lower than burning, but higher than emissions from mowing and manual control, which include some emissions from disposal of invasive plant material at a landfill or industrial composting facility. Emissions from grazing would be considerably lower if a local herd was available, although this estimate assumes manure would be managed onsite and not transported to a disposal facility.

CONCLUSIONS

Managers are often seeking predictability the results of control efforts and plant community responses, but the nature of invasive species management control tools, including target grazing, is influenced by many complex factors. No single treatment will work as a 'silver bullet' for any of the target invasive plant species reviewed in this report. All treatments have efficacy limitations, with efficacy directly correlated with funding and commitments to control efforts. Successful control requires long-term integrated weed management, focused on consistency in treatment application, long-term monitoring, regrowth management, and effective restoration efforts.

Targeted grazing treatments in Metro Vancouver will only be feasible if the logistical considerations outlined in Table 4 can be met, and funding and staff resources have been allocated to support the long-term partnerships necessary for effective control. If treatments are applied ad-hoc and do not meet the recommended timing, frequency, and duration, then control will be ineffective and represent a poor use of financial resources.

Successful control requires long-term integrated weed management, focused on consistency in treatment application, long-term monitoring, regrowth management, and effective restoration efforts.



The red barn at Aldergrove Regional Park provides excellent animal housing

RECOMMENDATIONS FOR A POTENTIAL PILOT STUDY

A site assessment was undertaken for Aldergrove Regional Park as a potential targeted grazing pilot study location. Aldergrove Regional Park is well suited for targeted grazing as it includes favourable infrastructure that could easily support a resident goat herd for Himalayan blackberry control. A 3-5 year operational grazing plan, field testing recommendations, and monitoring protocols were provided. Specific cost estimates for targeted grazing at Aldergrove Regional Park range from \$12,000-\$56,000 per year based on a combination of practitioner interviews and recommended frequency and duration requirements from literature review. Subsequent interviews with 'willing to travel' practitioners and the need for a part-time coordinator conclude that a realistic annual budget should be \$40,000 for a grazing practitioner and \$30,000/year for a part-time coordinator.

If Metro Vancouver decides to proceed with a targeted invasive plant grazing pilot study, the following steps should be considered:

- Ensure all steps in Table 4 have been addressed prior to implementation;
- Secure 3+ (preferably 5) years of funding to fully realize potential benefits of targeted grazing;
- Consider hiring a part-time coordinator to ensure contract details are clearly outlined, pre-treatment and post-treatment data is collected, and practitioner activity and deliverables are being met as outlined in the contract;
- Develop an agricultural business support policy; and
- Reach a long-term service agreement with a practitioner.

If logistical considerations cannot be met, and funding and staff resources are not available to properly support the long-term partnerships necessary for effective targeted grazing treatments, a pilot study is not recommended. It should be noted that Aldergrove Regional Park is unique and the learnings from such a pilot study may not be transferable to other park settings across Metro Vancouver.

A realistic annual budget should be \$40,000 for a grazing practitioner and \$30,000/year for a part-time coordinator.



The Red Barn and fenced pastures in Aldergrove Regional Park