

Black-tailed deer, plant and bird populations in the Southern Gulf Islands and Coastal Douglas Fir Zone: a primer for local communities interested in environmental stewardship

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Background

It is well-known that humans influence plant and animal species and communities directly by converting 'natural' habitats to human use. Academic researchers have spent decades documenting these changes and developing strategies to conserve valued species, including many rare mammals, plants, butterflies and birds. More recently, researchers have identified often severe, indirect effects of humans on valued native species, including those arising as a consequence of alien species introductions¹, and those arising when humans facilitate the population growth of species that depredate or displace other valued species^{2,3}. A familiar example in the first instance involves the introduction of the mosquito to Hawaii, which has contributed to the extinction of 28 species of Hawaiian bird species thus far. Familiar examples in the second instance involve the rise of urban and rural populations of raccoons, opossums, skunks, coyotes and red foxes, which can decimate some bird, reptile and small mammal populations when abundant.

Population increases of small-bodied predators often occur when humans eliminate large-bodied predators from the landscape, because large predators like wolves, cougars and bears prey on small predators, and by doing so limit their population size. The removal of large-bodied predators by humans has also resulted in the 'release' of deer populations throughout much of North America, most notably of white-tailed deer in southern Ontario and the US, where this species has caused up to 50% declines in the number of plant species present in forests monitored over the last half century². As a consequence, academics and wildlife managers now recognize that high deer densities threaten the persistence of many palatable plant species, including many iconic species of the coastal Douglas fir and Garry oak ecosystems of south-eastern British Columbia^{2,4,5}. Recent research in the Southern Gulf Islands of British Columbia further indicates that deer-induced changes in plant species abundance, community composition and the architecture of common palatable shrubs can profoundly affect native bird species that use understory plant species as feeding or nesting sites^{5,6}. The purpose of this note is to very briefly summarize these effects, and to encourage local communities to consider engaging in stewardship activities to reduce the chance of plant and bird species extinctions, and to promote the recovery and diversity of native plant and bird communities in British Columbia's most threatened ecosystems³.

Black-tailed deer in the Southern Gulf Islands

Black-tailed deer are endemic to the Southern Gulf Islands, as are wolves, cougars and bears. However, by the late 1800's, Europeans had removed large predators from the region⁸ and became the main agent of population control for deer via hunting, until at least the late 1970's. More recently, human hunting pressure has declined or been eliminated due to increased regulation and changing human sentiment, leading to the rapid growth of deer populations and their high abundance on many islands^{4,5,8}. In addition to being less dense, historic deer populations are likely to also have experienced

periodic extinctions, because wolves easily eliminate deer from smaller islands which are not always readily re-colonized thereafter^{8,9}. For example, although deer do swim, Ruxton Island has remained free of deer for 15 years despite lying within 1 km of DeCourcy Island, which supports a resident deer herd. Larger islands have also remained deer-free for at least 35 years (e.g., Portland, Russell and Moresby islands) despite their proximity to high density deer populations (e.g., Salt Spring and Pender islands). Taken together, these and other observations strongly suggest that browsing by deer on many Gulf islands was discontinuous in time and low on average prior to the last 2-3 decades. More recently, the rapid growth of deer populations, obvious signs of browsing and extirpation of many palatable spring ephemeral plants from some islands has led to concern about the long-term effects of unregulated deer populations on the viability of many plant species⁴, and on the abundance of island songbird populations which rely on understory plants for feeding and nesting^{5,6}.

Influence of deer browsing on Gulf Island ecosystems

Recent research indicates that at moderate to high densities (e.g., > 0.1/ha) deer have the capacity to prevent the growth of several species of meadow plants known to have been abundant historically⁴, including iconic species such as common and great camas, fawn and chocolate lilies, sea blush, blue-eyed mary, lupine, onions and various brodea. For example, figure 1 below shows the results of a 3 year experiment on Salt Spring island that employed 56 'open' and 'exclosed' plots planted with seablush and common camas in otherwise heavily-browsed Garry oak meadows⁴. Panel 'a' shows that exclosed plots, protected from browsing, saw rapid increases of seablush, whereas open plots declined to extinction with two exceptions. Panel 'b' shows that camas bulbs in plots protected from browsing were 3 times larger than bulbs in browsed plots, which declined in mass on average. Most remarkably, blooming by historically established lilies (great camas, fool's and harvest brodea) increased 12-fold in exclosed as compared to open plots⁴. These results suggest that browsing was lower historically on Salt Spring Island, but that unprotected plants are now rarely able to attain a sufficient size to reproduce. On many Gulf islands where livestock grazing and deer both occur, many palatable spring ephemerals have been extirpated, or in some cases persist as tiny grass-like individuals unable to escape predation by deer even after the removal of domestic livestock such as sheep, goats and cattle⁴.

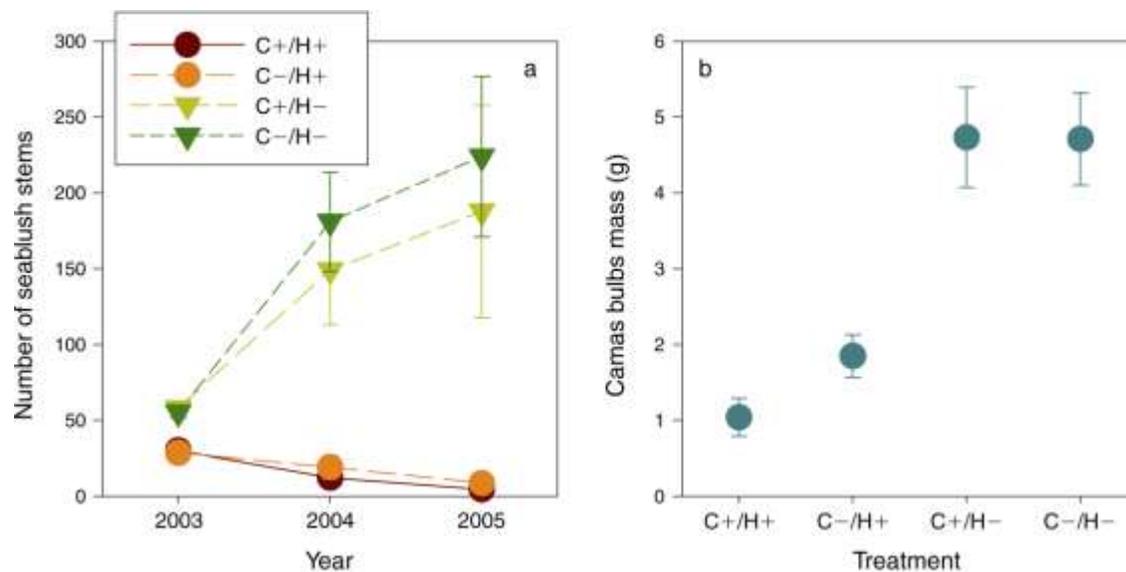


Figure 1. Fate of seablush and common camas under moderate or no browsing pressure over 3 years. 'H-' indicates plots protected from browsing versus open plots (H+; C+/- indicates whether or not introduced grasses were clipped to reduce competition for light and nutrients)⁴.

Related research also shows that deer have similar suppressive effects on many palatable species of shrubs, and that these effects in turn influence the abundance of many native songbirds⁵. For example, figure 2 below provides examples of ocean spray shrubs on North Ballenas (left), Little D'Arcy (centre) and Sidney (right) islands, where deer are rare or absent, moderately dense and very dense, respectively. Because all ocean spray regenerate from their base, they provide a sensitive indicator of the intensity of deer browsing and, consequently, the abundance of understory birds^{5,6}. Further, because older ocean spray stems senesce (e.g., as do ornamental lilacs and forsythia), we can expect the local extinction of ocean spray on islands with high deer density and no areas inaccessible to deer such as cliffs or fenced lots. On Breakwater Island, for example, where deer were scarce prior to the 1980s but are now abundant, approximately 30% of ocean spray shrubs are present as dead stems only. These ghosts of past ecosystems, where spring ephemerals were common 30 years ago but are now absent, also give us a lens into the future ecosystems of islands with persistent, high density deer populations.



Figure 2. The shape of ocean spray shrubs on islands with few or no deer (left) or moderate (c 0.2 deer/ha; centre) to high density (c 1 deer/ha; right).

Due to the close links between plant community composition, foliage volume and bird species abundance, researchers have also demonstrated dramatic effects of browsing on bird species abundance and diversity throughout North America^{2,6}, and most recently in the Southern Gulf Islands⁵. For example, in an extensive survey of 18 Gulf and San Juan islands with different deer densities, Martin et al.⁵ showed that many species that rely on understory shrubs for feeding and nesting were much less abundant on islands with high deer densities as compared to those with few or no deer. Examples include: rufous hummingbirds (9 times more abundant on islands with few versus many deer); song sparrows (4 times more abundant); yellow warblers (5 times more abundant); varied thrush (29 times more abundant); orange-crowned warbler (3.5 times more abundant); spotted towhee (25 times more abundant) and fox sparrows (9 times more abundant). Only one species, the dark-eyed junco, was significantly more abundant on islands with abundant deer, because juncos prefer open forests with little vegetative cover. As a consequence of these differences in bird species abundance, it is relatively easy for a trained observer to estimate deer density approximately in the Southern Gulf islands by recording the frequency and diversity of bird songs.

The future of plant and bird communities of the Southern Gulf Islands and Coastal Douglas Fir Zone

Many species of birds and plants common throughout the Pacific Northwest and still abundant in many mainland and Vancouver Island habitats are now rare or absent on smaller Gulf and San Juan islands

with moderate to high deer densities, and in many forests, woodlands and meadows on larger islands. The results above, plus those from the Queen Charlotte Islands where black-tailed deer are introduced⁶, further indicate that the progressive loss of understory plant species will continue where deer populations remain unregulated by large predators or human activities, leading to the extirpation of at least some bird and plant species from individual Gulf islands. Indeed, personal stories of the decline and extirpation of the most showy and palatable plant species are already common among islanders familiar with plant identification and 20-30 years of experience observing change on their own and other properties. Comparisons of island plant communities with few deer present in the 1970s but abundant deer populations today (e.g., Breakwater Island, Piers Island) also confirm that the extirpation of common spring ephemerals can occur in as few as 30 years, and indicates that widespread and still common shrub species such as ocean spray, mock orange, orange honeysuckle and flowering currant may also disappear as existing plants senesce. The absence of new arbutus recruits in moderate to heavily-browsed forests is also a common observation of long-term islanders, which further suggests that a slow process of 'biotic homogenization', wherein all plant communities converge on a common template of unpalatable species, is now underway on many islands.

As palatable plant species decline, it is inevitable that birds, insect pollinators and other species not yet studied in detail will also decline, further simplifying our natural communities and reducing the natural values that draw many humans to the Southern Gulf and San Juan Islands. These changes are not the result of 'natural' processes; they are an indirect effect of the human removal of large predators, leading to the release of deer populations, and the decline of palatable plant species and the birds that depend on them. Failing to act to reduce deer populations on islands where historically abundant species are currently declining or extirpated is a decision to favour one species, the black-tailed deer, over many others that are also native to our region and valued by many humans. Ultimately, failing to reduce over-abundant deer populations may also add new species to federal and provincial threatened species lists.

Options for controlling deer populations

Options for controlling deer populations are widely discussed in the popular and scientific literature (e.g., see^{3,10,11} and references therein), but highly controversial due to strong sentiments around the ethics of hunting. Because fertility control is advocated in a relatively limited set of circumstances and may require years to achieve modest reductions in population size¹⁰, hunting remains the most effective and widely-practiced method, including in many suburban areas of the Mid-west US. In rural areas, qualified hunters operating from tree stands offer an effective and safe means of limiting deer populations. On smaller Gulf Islands, limiting deer densities to <0.1/km is likely to allow the persistence of most palatable plants and shrubs and may only require the removal of a few deer annually. Alternatively, investing in fertility control or animal relocation will require government approval and the willingness of communities or government agencies to fund and carry-out the work. We encourage communities to consider all options as they develop local stewardship plans to conserve and restore native ecosystems.

References

¹ http://www.goert.ca/about_invasive_species.php

² <http://www.actionbioscience.org/biodiversity/rooney.html#educator>

³ <http://www.biodiversitybc.org/EN/main/where/132.html>

⁴ Gonzales, E.K. and P. Arcese. 2008. Herbivory, more than competition, limits early and established life stages of native plants in an invaded oak meadow. *Ecology* 89, 3282-3289.

⁵ Martin, T.G., Arcese, P. and Scheerder, N. 2011. Browsing down our natural heritage: Deer impacts on vegetation structure and songbird populations across an island archipelago. *Biological Conservation*, in press.

⁶ Allombert, S., Gaston, A.J., Martin, J.L., 2005a. A natural experiment on the impact of overabundant deer on songbird populations. *Biological Conservation* 126, 1-13.

⁷ MacDougall, A.S., 2008. Herbivory, hunting, and long-term vegetation change in degraded savanna. *Biological Conservation* 141, 2174-2183.

⁸ Shackleton, D., 2000. *Hoofed Mammals of British Columbia*. Washington University Press, Vancouver.

⁹ Darimont, C.T., Price, M.H.H., Winchester, N.N., Gordon-walker, J., Paquet, P.C., 2004. Predators in natural fragments: foraging ecology of wolves in British Columbia's central and north coast archipelago. *Journal of Biogeography* 31, 1867-1877.

¹⁰ <http://www.pzpinf.org/home.html>

¹¹ http://www.env.gov.bc.ca/cos/info/wildlife_human_interaction/UrbanUngulatesConflictAnalysisFINALJuly5-2010.pdf

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#Tara Martin grew up on Salt Spring Island and later migrated to Australia where she completed a PhD on grazing impacts on birds of the Queensland rainforests. Tara has also studied the impacts of deer on vegetation structure and bird communities in the Southern Gulf Islands of British Columbia as an NSERC post-doctoral fellow and is now adjunct professor of Forest Sciences at UBC. Tara's full-time post is a research scientist for Commonwealth Scientific and Industrial Research Organisation (CSIRO) of Australia, where she has written many papers on the uses of empirical data, expert knowledge, and ecological theory to build statistical and mathematical models to solve complex ecological problems and improve management performance.