"Managing For Wild Berries"

Philip J. Burton, Ph.D., R.P.Bio.
Manager of Northern Projects,
Pacific Forestry Centre, Canadian Forest Service,
3333 University Way, Prince George, B.C. V2N 4Z9
tel. 250-960-6130 e-mail pburton@pfc.cfs.nrcan.gc.ca

Introduction

One indicator of the evolution of timber-oriented forestry to sustainable forest management is expansion of the management portfolio to include a variety of non-timber values (Adamowicz and Burton 2003, Merry et al. 2005). Wild berries are a particularly attractive non-timber forest product (NTFP) on which British Columbia foresters and land managers can focus, for a number of reasons:

- Many wild berry species are important to First Nations, being central to their historical and current cultural practices, traditional ecological knowledge, nutrition, and trade;
- Berries are often a keystone resource for wildlife, especially bears;
- Edible berries are widespread and abundant in the northern and western forests of North America – almost every forest ecosystem has a berry species of interest;
- Wild berries continue to be widely utilized for subsistence, recreation, and sold for cash;
- There is widespread experience in wild berry management in Fennoscandia and eastern North America; and
- There are undeveloped opportunities for enhancing the biological productivity of wild berry species, and to develop sustainable economic activity based on this resource.

In this paper, I briefly explore what is known about the biology and management of a widespread berry species native to British Columbia. I point out that much is already known about the ecology of many of our edible berries, and that they can be managed sustainably with minimal conflicts with other land uses.

Biology and Ecology

There are a large number of edible berry species found in the forests of British Columbia and adjacent jurisdictions. Some of the most widely distributed and sought after wild fruits include raspberries, blackberries, salmonberry, thimbleberry, cloudberry (all of the genus *Rubus*), Saskatoons (*Amelanchier alnifolia*), gooseberries and currants (*Ribes* spp.), wild cherries (*Prunus* spp.), Oregon grapes (*Mahonia* spp.), salal (*Gaultheria shalon*), viburnums (*Viburnum* spp.) soapberry (*Sherpherdia canadensis*), and the many blueberries, cranberries and huckleberries of the genus *Vaccinium* (Turner and Szczawinski 1988). Many of these species belong to the rose and heather families (Rosaceae and Ericaceae, respectively), are insect pollinated, with fruits being ingested and subsequently dispersed by birds and mammals. Most of these plants are multistemmed woody shrubs or small trees, most have the ability to sprout or spread vegetatively, and most respond favourably to high light and nutrient levels. Many of our wild species have domesticated relatives (of European or North American origins), so we know quite a bit about their basic propagation and husbandry.

Ecologists have a good understanding of the distribution and habitat preferences of most vascular plants in British Columbia. This is because of a well documented history of plant collection (Douglas et al. 1992; see also www.eflora.bc.ca) and the thousands of vegetation relevés sampled in support of the development of the biogeoclimatic ecological classification system (Pojar et al. 1987, Meidinger and Pojar 1991). As a result, the site affinities and climatic envelopes that define the current ranges of plant communities and individual plant species can be easily derived from these databases. Field guides are available for all regions of the province, specifying the distribution of abundant and diagnostic plant species (many of them berry-producing shrubs), and the site attributes indicated by them (e.g., Banner et al. 1993, Beaudry et al. 1999). Information on the basic autecology of several shrub species (especially those that compete with conifer seedlings) has been compiled (Haeussler et al. 1990, Small and Catling 2005). Less well known is the successional response of most plant species over the course of stand development and ecosystem recovery after disturbance. Silvicultural and ecological research conducted over the last 10-20 years is providing some of this needed information, although fruit production patterns remain largely undocumented.

Light Response and Stand Development

Research conducted in the moist cold subzone of the Interior Cedar-Hemlock biogeoclimatic zone (ICHmc) of northwestern B.C. (in the Skeena River drainage near Hazelton) documented the light-response behaviour of five berry-producing shrub species (Burton 1998). Naturally occurring stands of black huckleberry (*Vaccinium membranaceum*), soapberry (*Shepherdia canadensis*), thimbleberry (*Rubus parviflorus*), devil's club (*Oplopanax horridus*) and red-osier dogwood (*Cornus stolonifera*) were sampled across gradients of overstory canopy shade, with their light environment quantified through the analysis of hemispherical ("fisheye") canopy photographs. Sample plots were located at different distances from cutblock edges, in and around canopy gaps, and in partially logged stands. Harvests of aboveground biomass and fruit crops were supplemented by growth ring analysis and stem dissection to derive various measures of annual productivity. Rates of vegetative growth and fruit production were combined to infer general empirical light-response functions for each species (Figure 1). Although species varied strongly in their ability to grow in deep and intermediate levels of shade, all species showed some positive response to higher light levels. In the case of black huckleberry and soapberry, productivity at light levels greater than 65% of above-canopy sunlight were not significantly different than that at full light.

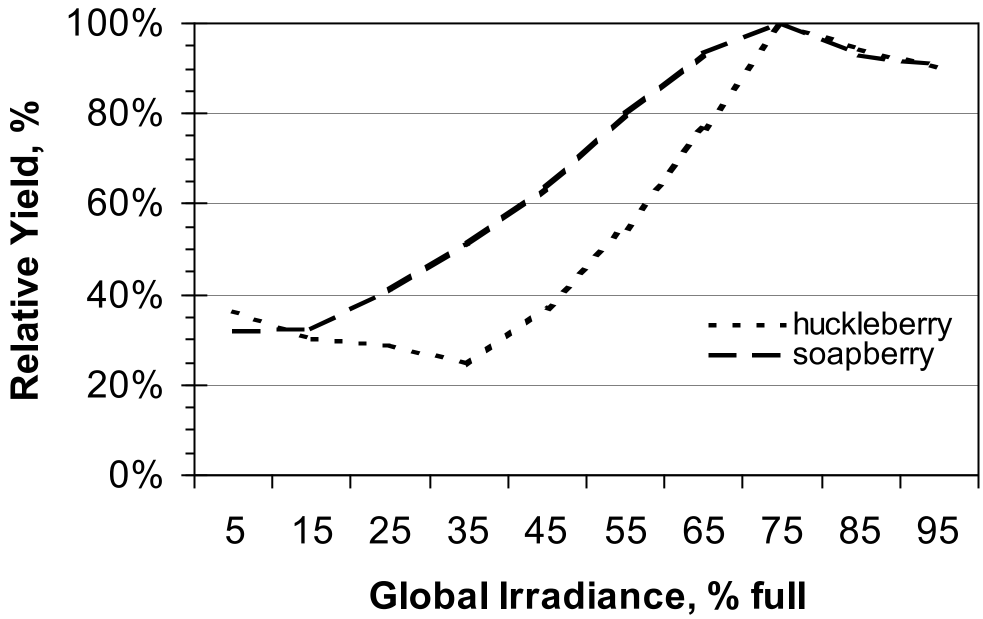

Figure 1. Yield response functions used for modelling two berry-producing shrub species (from Burton et al. 2000).

Additional research documented the distribution of known berry patches used in Gitxsan house territories to generate habitat suitability maps for key berry species (Burton et al. 2000). It was found that huckleberries were sufficiently abundant and productive in old-growth forests (characterized by canopy gaps and intermediate light levels) that many people targeted such areas for berry picking. Most black huckleberry picking, however, was done in recent clearcuts at intermediate elevations (950 to 1050 m). We also used a stand simulation model in conjunction with light-response curves to predict berry response to post-logging stand development, and devised recommendations for compatible management of berries and timber (Burton et al. 2000). The SORTIE/BC model is an individually-based, spatially explicit, empirically calibrated model of forest stand development and succession (Coates et al. 2003). Though not designed to simulate even-aged stand development after clearcut logging, the fact that this model can estimate ground-level irradiance under mixed species tree stands made it the best available tool for use in combination with the berry light-response curves derived earlier. Model results suggest that if we reduced stocking of conifers (down from target levels of 1200 stems/ha to the lowest allowable stocking levels of 700 or even 420 stems/ha), then suitable habitat for black huckleberry production can be extended by 4 to 7 years (44 to 78%) before tree canopy closure starts constraining huckleberry growth and production below 50% of its potential (Figure 2).

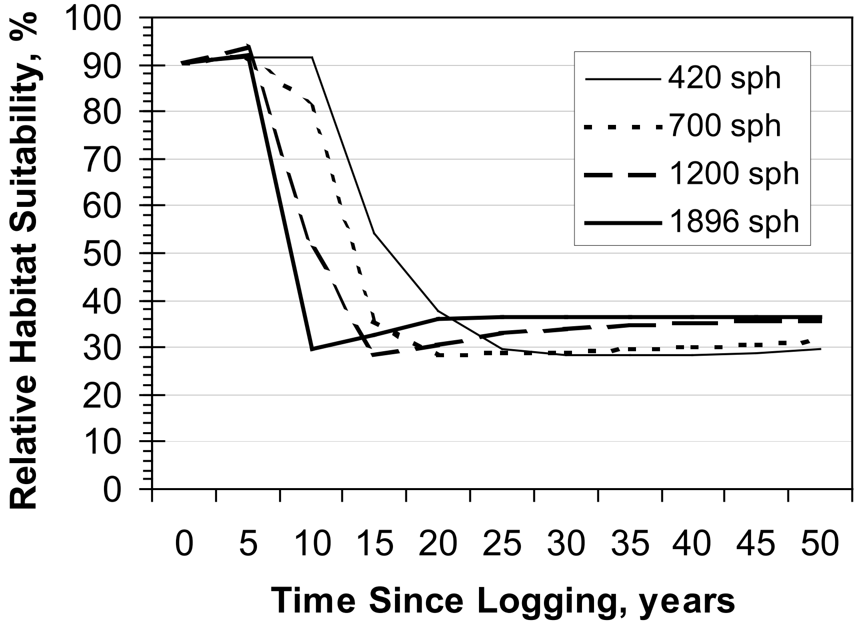

Figure 2. Simulated response of black huckleberry to post-clearcut stand development in the ICHmc2 (from Burton et al. 2000).

Management Options

Although some berry picking regularly occurs in old-growth forests, traditional Gitxsan berry patches were found at the site of old forest fires or near the alpine treeline, and were often maintained through the use of repeated prescribed burns (Gottesfeld 1994, Trusler 2002). Today, however, most huckleberries are picked in recent clearcuts, with logging being the primary agent of disturbance generating early seral (i.e., open) habitats. Consequently, it is possible to manage for a sustainable supply of huckleberries by managing the forest age class distribution – ensuring a continuous supply of open conditions in known, mid-elevation huckleberry habitat. Each Gitxsan house territory has its own opportunities and challenges in terms of balancing its forest age class distribution to promote berry production. For example, one house territory had 2661 ha of high-quality huckleberry habitat, some of which is currently in berry production; if forests are managed on a 120-year rotation, this means that the remaining forest should be logged at a rate of 532 ha per 20-year interval in order to sustain suitably open conditions for maximum berry yields (Burton et al. 2000). Most clearcut berry patches used in recent years had undergone broadcast slash burns for site preparation, however, raising the question of whether new berry patches will be as productive, because slash burning is no longer widely used for silvicultural site preparation.

In addition to forest rotation management, timber harvesting and silvicultural practices can be modified to protect wild berry resources, and other techniques (cultural practices) can be used to even enhance berry production. The selection of which technique to use where depends on habitat suitability, whether the land is part of the timber harvesting land base (THLB) and hence counted on for sustainable timber supply planning, and what the berry management expectations are. Three management emphasis options are proposed: to minimize damage to existing berry stands, to maintain them, or to enhance them (Table 1). The main challenge in British Columbia is to find berry management methods that are compatible with timber production, because most public forest land in the province is designated as part of the THLB, with logging rights and management obligations assigned to forest products companies.

Table 1. A wild berry management decision matrix (from Burton et al. 2000).

MANAGEMENT EMPHASIS	**TREATMENT OPTIONS**		
	Harvest Practices	**Silviculture Practices**	**Cultural Practices**
Minimize Damage *Applicable Conditions:* on THLB*; Habitat Capability Rated as Moderate – High; Abundance > threshold	• Use low impact harvesting	• Avoid spraying or cutting berry plants during brushing and weeding	• Not Applicable
Maintain *Applicable Conditions:* on THLB; Habitat Capability Rated as Moderate – High; Abundance > threshold	• Use appropriate silviculture system • Use low impact harvesting	• Low intensity broadcast burn • Avoid spraying or cutting berry plants • Use sheep for brushing and weeding • Space to low densities	• Not Applicable
Enhance *Applicable Conditions:* on or off THLB; Habitat Capability Rated as High; Abundance > threshold	(on THLB only) • Use appropriate silviculture system • Use low impact harvesting	(on THLB only) • Low intensity broadcast burn • Restock trees at low Densities • Use sheep for brushing and weeding • Space to low densities	• Prescribed burn (off the THLB) • Plant berry cuttings (off the THLB) • Brush around berry plants • Prune berry plants • Fertilize

* THLB = timber harvesting land base.

Timber harvesting treatments to minimize damage or maintain wild berry stands include the use of low-impact logging methods and the implementation of appropriate silvicultural systems. Logging with minimal ground disturbance (through use of cable logging or skidding on a sufficiently deep snowpack) can open up a stand without damaging the berry plants. Silvicultural systems must remove enough of the tree canopy to encourage berry growth and fruit production (e.g., typically >60% full sunlight), though some mature trees can be retained with no effect on berry yields. Partial canopy retention is usually achieved through the use of clearcutting with reserves, regular or irregular shelterwoods, and seed tree systems.

Appropriate silvicultural practices can maintain or even enhance wild berry production. Low-intensity broadcast burning can be used as a site preparation treatment that will enhance successful tree establishment, stimulate resprouting of many berry species, and can encourage higher and sweeter berry yields. Restocking cutblocks at low densities of trees (the minimum to meet regulatory requirements), or planting them in clusters, will extend the productivity of berry stands. Juvenile spacing (thinning the young stand of trees) can alternatively, or in addition, be used to keep the shading of berry plants to a minimum. Broadcast herbicide treatments for vegetation control are incompatible with wild berry management. Selective, ground-based brushing (whether using chemical or mechanical methods) can be used to retain desired berry species while removing other competing plant species. In so doing, the growth and yield of both crop trees and berries can be enhanced. It has also been suggested that the use of sheep for vegetation control may achieve the same desirable effects under certain circumstances.

A number of cultural practices can also be used to enhance berry production, especially where berry habitat capability is high and where there is little conflict with other land uses, such as steep or high-elevation areas that not considered commercially operable by the timber industry (i.e., designated as off the THLB). Low-intensity prescribed burns, a traditional management technique, can be used to kill older, respiring parts of berry plants, kill overtopping trees and larger shrubs, stimulate resprouting, and release nutrients. Manual brushing and weeding can achieve some of the same effects, as can mechanical pruning of the berry plants. Fertilization can also have beneficial effects. Finally, the planting of rooted cuttings or seedlings of desired species can be used to fill in or supplement the density of berry stands on suitable habitat.

There is extensive experience in the management of wild berries elsewhere in the world, particularly eastern Canada and northeastern United States (Yarborough 2003), and in Fennoscandia (Wallenius 1999). In northern Europe, wild berry production is well integrated into commercial timber production, facilitated by diverse land ownership and a large rural population that knows its land base (typically small land holdings) well. In eastern North America, wild blueberry (*Vaccinium angustifolium*) production has typically emphasized the culturing of stands on otherwise marginal land (often old agricultural fields). Management techniques in parts of Quebec, New Brunswick and Maine have evolved from the use of free burns (often with straw spread to help carry the fire), to the use of tractor-mounted burners, to a greater use of mechanical brushing and pruning, supplemented with fertilization, pest management and infill planting (Yarborough 2003). Though British Columbians may not wish to adopt these intensive "agricultural" techniques on a widespread basis, there is much we can learn from the berry management techniques successfully developed elsewhere.

Conclusions and Recommendations

Many options exist for maintaining and enhancing wild berry production in the forests of British Columbia. As most berry-producing species are light-demanding, early successional species, their management can be quite compatible with even-aged timber production and clearcut harvesting. When managed in this mode, monitoring and manipulating the age structure of the forest is important, and a concerted effort must be made to ensure a continuous supply of open habitats within the area from which sustained berry yields are expected. Furthermore, vegetation management must explicitly avoid killing desired berry species. Practices such as reduced stocking and juvenile spacing can be used to prolong open conditions and hence the window of berry production.

Opportunities for wild berry management and enhancement are even more pronounced where this does not conflict with the growing of trees. Hence berry management planning and practices must take guidance from resource emphasis zoning on public land. Conflicts with the timber industry can be avoided by managing off the THLB where possible – at high elevations, on steep or rocky sites, in hydro line rights-of-way. Repeated use of low-intensity fire is the traditional method used for maintaining and stimulating the productivity of wild berry patches, especially wild blueberries and huckleberries. Mechanical brushing and pruning may achieve the same results, but considerable research is needed to determine the optimal methods for encouraging berry production by the berry species found in this part of the world. Monitoring and adaptive management will be part of any successful berry management program.

Wild berry production can be very important to First Nations land managers, subsistence users, recreational users and commercial pickers. This importance needs to be emphasized and documented when conflicts with other land uses such as timber production arise. The development of sustainable commercial berry harvesting and processing capacity (e.g., Burton 1999) can enhance the credibility of wild berries as an important forest value and an important land use. In addition, the commercial utilization of wild berries can also provide local economic diversification, employment opportunities, and motivation for the more diverse management of forests and other wildlands.

References Cited

Adamowicz, W.L., and P.J. Burton. 2003. Sustainability and sustainable forest management. Pages 41 to 64 in P.J. Burton, C. Messier, D.W. Smith, and W.L. Adamowicz, editors. Towards Sustainable Management of the Boreal Forest. NRC Research Press, Ottawa, Ontario.

Banner, A., W. MacKenzie, S. Haeussler, S. Thomson, J. Pojar, and R. Trowbridge. 1993. A Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region. Land Management Handbook 26. B.C. Ministry of Forests, Victoria, B.C. 2 vols.

Beaudry, L., R. Coupé, C. DeLong, and J. Pojar. 1999. Plant Indicator Guide for Northern British Columbia: Boreal, Sub-Boreal and Subalpine Biogeoclimatic

Zones. Land Management Handbook 46. B.C. Ministry of Forests, Victoria, B.C. 134 p.
Burton, C. 1999. Starting a Non-timber Forest Products Enterprise: The Wilp Sa Maa'y Harvesting Co-operative. Ecoforestry 14(4):20-23.
Burton, P.J. 1998. Inferring the Response of Berry-Producing Shrubs to Different Light Environments in the ICHmc. Final Report on FRBC Project SB96030-RE, prepared for the Science Council of B.C. Symbios Research & Restoration, Smithers, B.C. 45 p.
Burton, P., C. Burton, and L. McCulloch. 2000. Exploring Options for the Management of Wild Berries in the Kispiox Forest District: Phase One of a Pilot Project Focusing on the Suskwa River Area. Report prepared for the B.C. Ministry of Forests, Kispiox Forest District. Symbios Research & Restoration, Smithers, B.C. 56 p.
Coates, K.D., C.D. Canham, M. Beaudet, D.L. Sachs, and C. Messier. 2003. Use of a spatially explicit individual-tree model (SORTIE/BC) to explore the implications of patchiness in structurally complex forests. Forest Ecology and Management 186: 297-310.
Douglas, G.W., G.B. Straley, D.V. Meidinger, and J. Pojar, editors. 2002. Illustrated Flora of British Columbia, Volume 8: General Summary, Maps and Keys. B.C. Ministry of Sustainable Resource Management, Victoria, B.C. 457 p.
Gottesfeld L. 1994. Aboriginal burning for vegetation management in Northwest British Columbia. Human Ecology 22(2):171-188.
Haeussler, S., D. Coates and J. Mather. 1990. Autecology of Common Plants in British Columbia: A Literature Review. FRDA Report 158, Forestry Canada and B.C. Ministry of Forests, Victoria, B.C. 272 p.
Meidinger, D., and J. Pojar, editors. 1991. Ecosystems of British Columbia. Special Report Series 6. B.C. Ministry of Forests, Victoria, B.C. 330 p.
Mery, G., R.I. Alfaro, M. Kanninen, and M. Lobovikov. 2005. Changing paradigms in forestry: repercussions for people and nature. Pages 13 to 20 in G. Mery, R. Alfaro, M. Kanninen and M. Lobovikov, editors. Forests in the Global Balance – Changing Paradigms. IUFRO World Series Volume 17. International Union of Forest Research Organizations, Vienna, Austria.
Pojar, J., Klinka, K., and Meidinger, D. V. 1987. Biogeoclimatic ecosystem classification in British Columbia. For. Ecol. Manage. 22: 119-154.
Small, E., and P.M. Catling. 2005. Poorly known economic plants of Canada – 45. Eastern huckleberries (*Gaylussacia* spp.) and western huckleberries (*Vaccinium* spp.). The Canadian Botanical Association Bulletin 38(2):15-23.
Trusler, S.G. 2002. Footsteps amongst the berries : the ecology and fire history of traditional Gitsxan and Wet'suwet'en huckleberry sites. M.Sc. Thesis, University of Northern British Columbia, Prince George, B.C. 204 p.
Turner, N.J., and A.F. Szczawinski. 1988. Edible Wild Fruits and Nuts of Canada. Fitzhenry & Whiteside, Markham, Ontario. 212 p.
Wallenius, T.H. 1999. Yield variations of some common wild berries in Finland in 1956-1996. Annales Botanica Fennici 36:299-314.
Yarborough, D.E. 2003. Wild Blueberry Grower's Guide. The University of Maine, Orono, Maine.