STERILE INSECT RELEASE PROGRAM

GUIDE TO THE SIR PROGRAM

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CHAPTER 1
INTRODUCTION

The *Sterile Insect Release Program* is an area-wide, environmentally-friendly approach to the management of codling moth populations in the fruit-growing areas of the Okanagan, Similkameen and Shuswap Valleys. The *Program*, which is focused on the use of sterile insect technology, was launched in 1992 after thirty years of research, and a decade of building consensus and planning for implementation. Today, all or portions of four regional districts currently participate in the *Program*, including the Regional District of Okanagan Similkameen (RDOS), the Regional District of Central Okanagan (RDCO), the Regional District of North Okanagan (RDNO), and the Columbia Shuswap Regional District (CSRD).

This *Guide* is an important source of information on the *SIR Program*. It introduces and provides details on the *Program's* key components including its scope of services, model of governance, and approaches to cost-recovery and cost-sharing. The *Guide* also reviews the *Program's* results to date, and outlines the various economic and socio-environmental benefits that can be attributed to the *Program*. Finally, the *Guide* looks ahead to the future of SIR. Opportunities available in coming years are considered, as are challenges that the *Program* may need to confront.

The *Guide* is written primarily for local elected officials, including regional district directors and members of municipal councils. Effort has been made in developing the *Guide* to anticipate and address the information needs of these decision-makers. The *Guide* is also a resource for local residents, fruit growers and fruit industry stakeholders. Finally, persons interested in inter-jurisdictional services and environmentally-friendly methods of pest management may find the *Guide* of value.

CHAPTER 2
PROGRAM OVERVIEW

The *SIR Program* exists to help control codling moth populations in the Okanagan, Similkameen and Shuswap Valleys. The codling moth is a pest that threatens apple and pear crops — pome fruits — in fruit-growing regions around the world, including those in BC's Southern Interior. Female adult moths lay their eggs on the leaves of fruit trees, or directly on the fruit itself. When the eggs hatch, small larvae emerge and burrow their way into the fruit where they feed for about three weeks. Once satisfied, they emerge as large caterpillars to continue their development.

Soon after its arrival in British Columbia in the early 1900s, the codling moth began to inflict extensive damage in apple and pear orchards. For many decades, fruit growers struggled to contain the moth and the damage it caused. Chemical pesticides of various varieties were used in increasing quantities to slow the insect's spread and minimize crop loss. The moth's ability to build resistance to even the most toxic pesticides, however, limited the effectiveness of chemical-based management strategies.

Concerns over unacceptably high rates of codling moth damage, coupled with a desire to significantly reduce the use of chemical pesticides, prompted fruit growers, local governments and scientists to search for a new approach to codling moth management that was effective, affordable and environmentally-friendly. They turned to sterile insect technology (SIT), which was developed in the 1930s and first applied to control screw worm pests in 1953. SIT, described as "birth control for insects", works by pairing sterile male insects with wild female insects so that the females are unable to produce viable offspring. Thirty years of research and development by scientists at the Pacific Agri-Food Research Centre in Summerland confirmed that the technology was well suited to address the codling moth issue in the fruit growing areas of the Southern Interior.

SIR PROGRAM

The *Sterile Insect Release Program*, built around the use of sterile insect technology, was officially launched in 1992. From the outset, three points were understood by the *Program's* developers. First, it was understood that the *Program* could not be introduced in all parts of the *Program's* service area at the same time. This area, at 21,000 km^2 in size, was too large to make broad, area-wide introduction feasible.

Second, it was understood that existing codling moth populations at the time were too high to simply begin releasing sterile insects. Sterile insect technology is not effective in environments with high concentrations of wild male moths. High concentrations make it difficult for sterile male moths to effectively compete for

mates. Intensive "clean-up" efforts using a range of pest control techniques would be needed before sterile insects could be released. Finally, it was understood that urban host trees would need to be targeted, in addition to commercial orchards, for the *Program* to be effective. In 1992, there were over 150,000 host trees in urban parts of the service area. Each of these trees — in particular, those within 200 metre buffer zones adjacent to commercial orchards — had the potential to spread infestations.

Based on these points, the *Program* was introduced slowly and in stages. The broader service area was divided into three separate zones: Zone 1, which includes most of RDOS[1]; Zone 2, which includes all of RDCO, with the exception of Lake Country; and Zone 3, which includes Lake Country, the western portion of RDNO and a portion of the Shuswap. The zones are shown in Figure 2.1 on the following page.

The *Program*, it was determined, would concentrate its energies and resources on Zone 1 first. After suitable progress was made there, efforts would extend northward into Zones 2 and 3.

Codling Moth Resistance

The codling moth is one of the more invasive and challenging pests for apple and pear growers in BC's Southern Interior.

The moth was first documented almost two thousand years ago in Europe, but didn't make it to North America until the 1800s. By 1916 it was causing extensive damage throughout the Okanagan and Similkameen Valleys. Because it is not indigenous to BC, there are few native predators to keep the population under control. Growers, as a result, have to rely on other methods to deal with the insect. For many decades, the use of large doses of chemical pesticides was the default technique.

The codling moth is notorious, however, for its ability to become resistant to even the most toxic pesticides. In the late 1920s growers noted that the moth was showing resistance to lead arsenate, which was being applied four to five times per year at the time. By 1945, when the moth was able to withstand applications of six to ten times per year, lead arsenate was taken out of use. DDT took over, but only until the late 1950s when it, too, was found to be no longer effective. Organophosphates then became the chemicals of choice. Since the early 1990s cases of increased tolerance to these agents have been reported, which have raised concerns regarding the agents' long-term effectiveness. In part because of these concerns (and in part because of environmental and health concerns), organophosphates are now being phased-out.

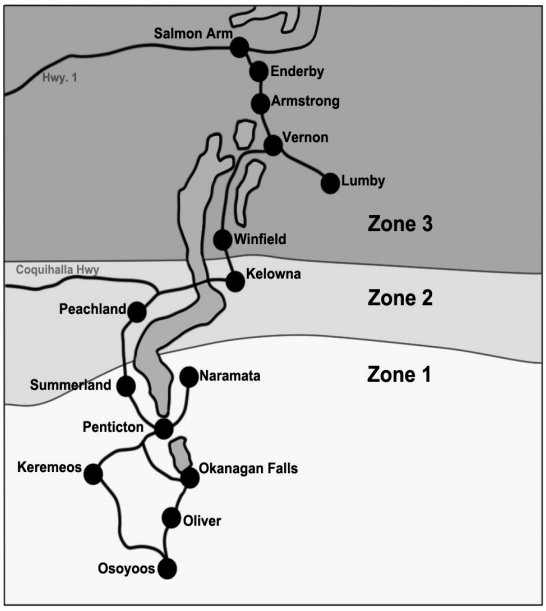
For each zone, a three-stage strategy was developed.

- *Stage 1* — The first stage would focus on clean-up. In this stage, staff would work to reduce wild moth numbers to the point at which sterile male codling moths, upon release, would outnumber their wild counterparts by a ratio of at least 40:1. A range of pest control methods would be used to cull population levels.

[1] Zone 1 also included the Creston Valley, within the Regional District of Columbia Kootenay (RDCK). RDCK withdrew from the service in 2007.

- *Stage 2* — At stage two, the *Program's* sterile insect release technology would be employed. Between 10 and 14 million sterile codling moths, raised at the program's rearing facility in Osoyoos, would be released each week during the summer growing season. At these numbers, the sterile moths would be able to out-compete wild males and mate with the wild female moths.

Figure 2.1
SIR Program Zones



- *Stage 3* — Stage three would involve ongoing monitoring. SIR field workers, assisted by growers and urban host tree owners, would regularly check codling moth levels. In urban areas, monitoring would be done through visual inspections, and using corrugated cardboard bands designed to trap moth larvae. Monitoring in commercials orchards would involve visual inspections, and using traps designed to catch wild male moths. Ongoing population control methods, including the regular release of sterile insects, would be applied to keep moth numbers down.

Stage one clean-up work began in Zone 1 in 1992, followed by stage two sterile insect release in 1994. Clean-up work in Zone 2 began in 1997, then in Zone 3 in 2000. Sterile insects were being released in all zones beginning 2003.

The three stages, it should be understood, do not typically proceed in straight-line fashion, with one ending and another beginning. In all zones, stage one sterile insect release runs concurrently with stage three monitoring. And, from time to time, intensive stage one clean-up efforts need to be reintroduced to deal with infestations that occur. In short, activities that fall under the different stages are used when and where they are required.

PROGRAM COMPONENTS

Today, the rearing and release of sterile codling moths remains at the heart of the *SIR Program*. In its entirety, however, the *Program* features a variety of components, the full range of which is outlined in the following points:

- *Sterile Insect Production* — Each year, the *SIR program* produces about 220 million sterile codling moths at its Codling Moth Mass Rearing Facility in Osoyoos. The $7.4 million facility was constructed using federal and provincial funding, and was opened in 1993. *Program* staff run the facility.

- *Sterile Insect Release* — The sterile moths are released weekly into commercial orchards from May through the end of August.

- *Population Monitoring* — SIR field staff monitor wild codling moth populations in commercial orchards and in urban areas to identify "hot spots" where infestations may occur (or have occurred). Data are collected, then organized in the *Program's* GIS. Monitoring efforts in urban areas are concentrated primarily in buffer zones — that is, in residential areas within 200 metres of commercial orchards.

- *Urban Visits* — Infestations that exist in urban areas have the potential to spread to adjacent orchards, and for that reason steps must be taken to ensure that urban host tree sites are clean. *Program* staff meet with urban owners of host trees to provide information about the *Program*, and to help owners understand the steps they can take to keep their trees free of codling moths. In cases of infestation, or where a homeowner is not willing to maintain a tree, outright removal of the tree is often required.

- *Enforcement* — The legislation for the *SIR Program* puts the onus on growers and owners of host trees in urban areas to clear their property of destructive pests, and to prevent infestation. The same legislation authorizes *Program* staff to enter onto property to determine compliance and to bring the property into compliance by any means considered necessary.

- *Education* — *Program* staff make presentations and set-up kiosks at various events to raise awareness of the codling moth and the *SIR Program*.

PROGRAM GOAL

At the time of its introduction, the goal of the *Program* was to completely eradicate codling moth from all zones by 1999. By the late 1990s, however, it became clear that this original goal was too ambitious. The size of the *Program's* service area, and the presence of thousands of urban sources of codling moth, made eradication unfeasible.

Control (or suppression) of moth populations below a specific threshold became the *Program's* new objective. The threshold in place today is less than 0.2% codling moth damage on at least 90% of all commercial pome fruit acreage in the service area as a whole. The target year to reach this threshold was 2008. In order to reach that threshold, the *Program* undertook a *Transitional Clean Up Plan* from 2005 to

2007. The goal of that *Plan* was to achieve a result by 2007 of less than 0.5% damage on at least 95% of all acreage for the service area as a whole.[2]

The inability to eradicate the codling moth, and the resulting shift in the *Program's* objective from eradication to suppression, means that the release of sterile moths and the monitoring of codling moth populations remain ongoing and concurrent activities in all zones. It is also the case that growers in most parts of Zones 2 and 3 must continue to make use of methods other than sterile insect technology to assist in control efforts. In Zone 1, where the release of sterile insects has occurred over the longest period of time, the need for chemical pesticides and other alternatives is the lowest. Even here, however, the *SIR Program's* sterile insect technology comprises only one component (albeit the chief component) of an integrated pest management program for growers.

Control Threshold

As noted, the threshold level in place today is defined as less than 0.2% codling moth damage (as sampled at harvest) on at least 90% of all commercial pome fruit acreage in the service area as a whole. For some stakeholders, this threshold is deemed adequate; for a growing number, however, the current threshold allows for too much codling moth activity and too much crop damage.

A stricter threshold that tolerates lower numbers of wild moths and lower amounts of damage — and that is already being achieved in Zone 1 — is preferred by some. Proponents of a new threshold suggest that the long-term success and sustainability of the Program cannot be assured without a more ambitious target. A lower threshold of less than 0.05% damage on at least 98% of all commercial acreage is identified by some proponents as both an attainable and necessary goal.

The text box on the following page lists some of the pest control methods that are used by growers, in addition to SIT.

[2] Results to date for the *Program* are reported in Chapter 6 of the *Guide*.

Methods of Control

Sterile insect technology (SIT), on which the *SIR Program* is based, is not a stand-alone method for the control of codling moth populations. Use of SIT does reduce the need for other approaches, and may eliminate the need for specific methods. In most cases, however, growers must use SIT in combination with other control techniques. The types of methods used by growers in addition to SIT include:

- ***Mating Disruption*** — This method uses pheromone dispensers to confuse wild male moths and prevent them from reproducing with females.
- ***Pesticides*** — Chemical pesticides, including organophosphates such as azinphos-methyl, are sprayed at key times to cull moth populations. Growers can also select from several newer, reduced-risk products to apply (as recommended) to protect fruit.
- ***Fruit Stripping*** — Infested and damaged fruit is removed from orchards and destroyed in order to prevent further spread of the insect.
- ***Tree Banding*** — Corrugated cardboard bands are placed around host trees to trap and destroy codling moth larvae.
- ***Tree Removal*** — Unwanted and/or infested host trees are removed.

Growers may also help to control codling moth populations by making use of various predators such as ground beetles, birds and spiders that are present in the orchards. One advantage of SIT is that it does not threaten these natural control agents, but rather allows them to exist and do their jobs. Broad-spectrum chemical sprays, conversely, can eliminate predators, or drive them away.

CHAPTER 3
LEGISLATIVE FRAMEWORK

The authority for the *SIR Program* is rooted in a 1989 amendment to the province's *Municipal Enabling and Validating Act* (MEVA). Section 283 of the statute was added to give a total of five regional districts — the four that participate today, plus the Regional District of Central Kootenay — authority to establish, by bylaw, a sterile insect release program with a single and autonomous board of directors to oversee the program. In that same year, each of the five regional districts named in section 283 adopted its own service establishment bylaw to implement the authority granted under *Act*.

In 1990, Cabinet issued the *Okanagan-Kootenay Sterile Insect Release Service Regulation (17/90)* to provide detail to key parts of section 283. The *Regulation* set out the methods of cost-recovery and cost-sharing for the *Program*. The *Regulation* also gave explicit authority to the SIR Board and its agents to enter onto property for the purpose of releasing sterile insects and, where necessary, order (and even undertake) clean-up efforts to prevent infestation. An additional regulation was issued in 1995 to provide authority for the Board to enter into funding agreements with senior governments and others, and to provide compliance grants (i.e., incentive programs) to property owners and growers.

Between 1995 and 2010, there were only a few additional legislative initiatives at the regional district level — on the whole these resulted in very minor changes to the *Program*. In 2011, however, amendments to the participating regional districts' establishing bylaws resulted in significant changes to the *Program's* governance structure.[3] For example, the number of voting Board members increased from four to a total of eight.

Additional changes to the legislative framework may occur in the future, either at the regional district level and/or the provincial level. Stakeholders have indicated a desire, specifically, for legislative clarity from the province on the issue of service withdrawal as it relates to municipalities and electoral areas within participating regional districts. As a regional district service, the *SIR Program* would appear to be subject to the service review and withdrawal provisions of the *Local Government Act*. The nature of the *Program*, on the other hand, would appear to preclude the departure of any single jurisdiction without the agreement of all participants and/or significant guarantees. The risk of re-infestation in a departing jurisdiction, and the implications of such re-infestation for remaining jurisdictions, would undermine the efficacy of the entire service.

It is worth noting that the province was asked in 2007 for guidance on the proposed withdrawal from the *Program* by the Regional District of Columbia Kootenay. The

[3] The Board's structure is explained in Chapter 4 of the *Guide*.

province directed the *Program* participants to negotiate the matter themselves. The province noted that the withdrawal of one regional district required the agreement of all participating regional districts.

In dealing with the issue of withdrawal by a municipality or electoral area, the province may take a similar approach and direct the *Program* participants to reach their own agreement.

CHAPTER 4
GOVERNANCE & DELIVERY

The SIR Board of Directors is the chief governing body for the *SIR Program*. All key decisions related to the *Program*, its facilities and its activities are made by the Board. The Board is ultimately accountable to the participating regional districts.

As noted in the previous chapter of the *Guide*, the structure of the Board was changed in 2010. Amendments to the participating regional districts' establishing bylaws increased the number of voting members from four to a total of eight. The eight member Board is now composed of five regional district appointees — one member each from RDCS, RDNO, and RDOS, and two members from RDCO — and three grower representatives nominated by the BC Fruit Growers' Association. Each Board member receives one vote on every issue. A straight majority decides every vote with the exception of financial matters, which also require the approval of a minimum of three of the five regional district directors.

Under section 283 of the 1989 MEVA, the SIR Board is identified as a corporation. With this status, the Board has authority to set its own budgets and determine its own operating procedures — the Board does not need the approval of the *Program's* participating regional districts in these matters. The Board also has the authority, granted under BC Reg 17/90, to issue and enforce clean-up orders against property owners. Such orders often require the removal of host trees.

COMMITTEES OF THE BOARD

There are two standing committees established by the Board to provide advice on matters of operation and governance:

- *Operation Advisory Committee* — The Operation Advisory Committee is the Board's technical and operational advisory body. Members include growers, researches, regulators, and others. The intent of the Committee is to give industry a prominent role in the design and delivery of the *Program*.

- *CAO Committee* — The CAO Committee is comprised of the Chief Administrative Officers of the four participating regional districts. The Committee provides input as necessary concerning SIR governance, SIR administration, and *Program* budgets.

SIR ADMINISTRATION

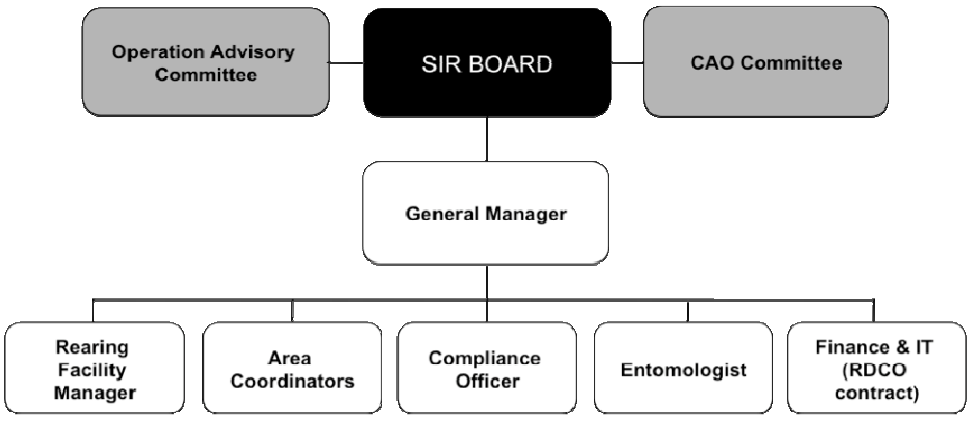
The SIR Administration, headed by the SIR General Manager, reports to the Board and is responsible for delivering the various components of the *Program*.

Approximately 16 full time staff and 67 seasonal staff work for the *Program*, including:

- a Program Entomologist to advise on the rearing and release of sterile moths, and to investigate hot spots
- a Compliance Officer and four Area Coordinators to carry out enforcement activities and coordinate Field Staff
- several Field Staff in each of the three zones to undertake sterile insect release activities, to monitor moth populations, and to collect data
- Quality Control, Rearing Technicians and Facility Engineers at the Codling Moth Mass Rearing Facility

Financial administration and information technology support are provided by RDCO Administration on contract to the *Program*. Figure 4.1 presents the *Program's* organizational structure.

Figure 4.1
SIR Organizational Chart – 2011



Program Stakeholders

The SIR Board of Directors and SIR Administration are key stakeholders in the *Program* with important roles to play in helping to ensure the *Program's* success. Other stakeholders include:

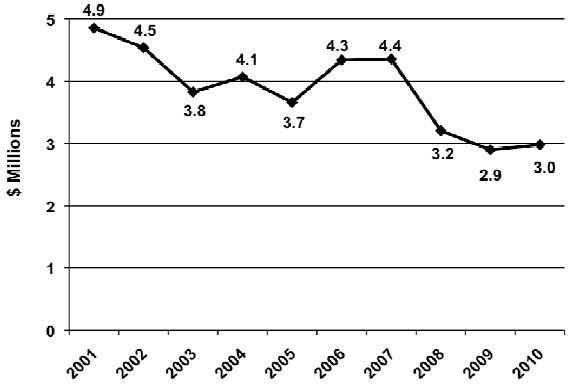
- ***Participating Regional Districts*** — The *SIR Program* is a service of the four participating regional districts. Through the adoption and amendment of their SIR establishing bylaws, the regional districts help to define (and re-define) the *Program's* structure and activities. The regional districts also advocate on behalf of the *Program*, and facilitate the collection of parcel and property value taxes.
- ***Growers*** — Growers are responsible for developing sustainable pest management plans for their orchards — plans that integrate the *Program's* SIT with other, complementary measures (as required). Growers cooperate with *Program* staff in insect monitoring and release efforts, and report moth infestations and the presence of unmanaged host trees. Growers support the *Program* though parcel tax payments.
- ***Urban Host Tree Owners*** — Urban property owners with host trees are responsible for preventing the proliferation and spread of pests, including codling moth. Owners must also allow access to *Program* staff and comply with codling moth control orders.
- ***Fruit Handlers*** — Packinghouses and other fruit handlers assist growers in understanding codling moth biology, and methods (including SIT) to deal with the insect. Fruit handlers are responsible for sanitizing fruit bins and containers.
- ***Fruit Tree Retailers*** — Retailers may support the *Program* by volunteering to participate in an SIR host tree registry. They advise buyers of the need to prevent infestation, and on the methods of prevention.
- ***Senior Government Scientists*** — Entomologists with both the federal and provincial governments provide technical advice on the rearing and release of sterile insects, as well as on future directions for the *Program*.

The ongoing success of the *SIR Program* is dependent on the support of all stakeholders.

CHAPTER 5
PROGRAM COST

The total cost of the *SIR Program* in 2010 was slightly under $3 million. Figure 5.1 charts total program costs for the past ten years, since 2001.[4] Over this time, the *Program* has been able to bring codling moth populations under control in most parts of the service area. Greater control has enabled the *Program* to lower its costs.

Figure 5.1
Total Annual Program Cost – 2001 to 2010



In reviewing Figure 5.1, two periods stand out:

- *2003-2004* — In 2003, the *Program* expanded its release of sterile moths into Zones 2 and 3. Various challenges with implementation in those areas — including the Okanangan Mountain wildfires affecting Kelowna — resulted in an increase in recorded levels of infestation. Additional clean up efforts, over and above sterile insect release, were introduced in 2004 to combat these increased levels. The additional measures caused *Program* costs to increase in that year.

- *2006-2007* — The cost increases shown for 2006 and 2007 coincided with the *Transitional Clean-Up Plan* noted earlier. All of the funding required for the *Clean-Up Plan* was provided by senior governments. The end of the *Transitional Plan* and the entry into the period of *Program* sustainability allowed costs to continue their earlier downward trend.

Figure 5.2 presents forecasted future costs, as reported in the *Program's 2011 – 2015 Financial Plan.*

COST RECOVERY

Figure 5.3 shows that growers and general taxpayers throughout the SIR service area pay the bulk of the *Program* cost today. Growers pay primarily through parcel taxes, levied on a per acre basis (all growers in all zones pay the same per acre

[4] All costs in all figures are unadjusted for inflation.

amount). In 2005, the parcel tax was set at $101 per acre. In 2010, the tax was set at $139 per acre, and generated a total of $1.27 million for the *Program*.

General taxpayers (including growers) throughout the SIR area pay property taxes toward the *Program*. The taxes are paid on the assessed value of land only. In 2010, property value taxes raised $1.71 million for the *Program*.

Figure 5.4 compares the 2010 parcel and property tax revenues against amounts raised in earlier years. As illustrated, the total property tax burden reached a high of $2.32 million in 2005 before dropping to current levels.

In the coming years, the parcel tax rate and the property value tax rate are expected to increase at approximately 3% per year. Minor parcel tax and property value tax revenue increases are also expected (see Figure 5.5 on the following page).

Ongoing losses in the number of taxable acres under production require parcel tax and property value tax rates to be reviewed annually to ensure adequate program funding. In 2010,

Figure 5.2
Forecasted Future Costs – 2011 to 2015

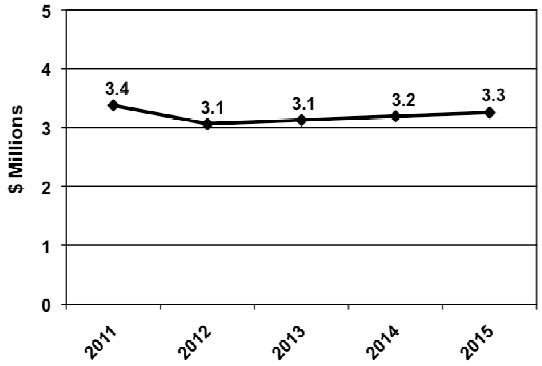


Figure 5.3
Sources of Revenue in 2010
($ millions)

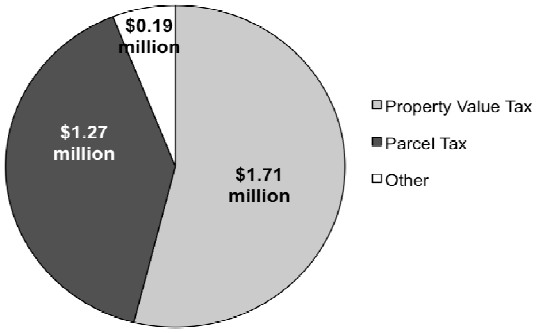


Figure 5.4
Parcel and Property Tax Funding
2001 – 2010

there were approximately 9,131 acres (3,695 hectares) of orchards paying into the *Program*. This number is expected to drop by 2% annually in the years ahead.

Traditionally, the *SIR Program* has depended on senior government funding to pay for special projects. Figure 5.6 shows the annual senior government contributions from 2001 to 2010. In 2005, the provincial government (through the Investment Agricultural Foundation of BC) approved $2.6 million over the 2006-2007 period to assist with the cost of the *Transitional Clean Up Plan*. No provincial funding was received in 2008, and less than $200,000 was received over the 2009-2010 period. Senior government and BCFGA funding support in the order of $225,000 is expected to be approved in June 2011.

Figure 5.5
Future Total Annual Program Revenues
2011-2015 Financial Plan

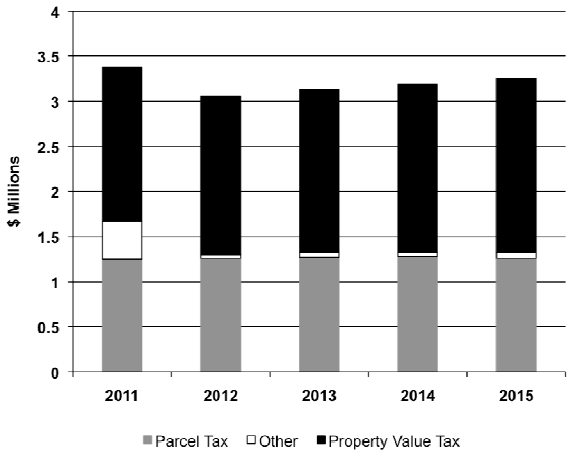
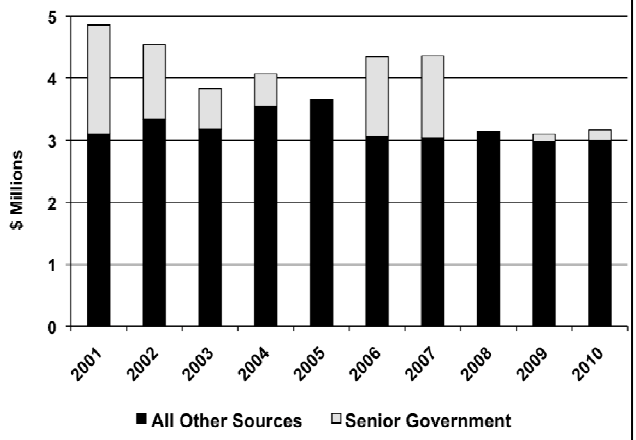


Figure 5.6
Annual Senior Government Funding – 2001 to 2010
Shown as Portion of Total Program Revenue



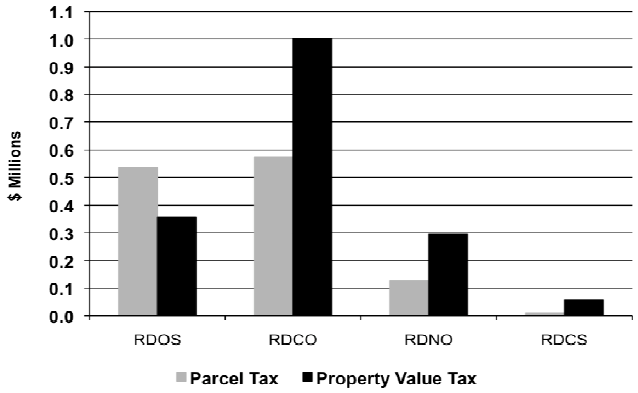
COST ALLOCATION

As explained, commercial pome fruit growers throughout the program area pay towards the total *Program* cost in the form of an annual per-acre parcel tax. These taxes are requisitioned each year through the participating regional districts. The amount assigned to each regional district is determined by the number of acres under production within the jurisdiction.

In 2010, the amount collected from general property taxpayers in the form of property tax revenues was $1.71 million. This amount was spread among the participating regional districts on the basis of converted assessment (land only), as it is every year. Figure 5.7 on the following page shows how much property value tax revenue was collected within each participating regional district in 2010. The figure

shows that the largest portion of the general tax burden was born by RDCO — a result that is consistent with breakdowns from earlier years. RDCO's relatively high land values help to account for this result. The fact that all municipalities and electoral areas within RDCO contain commercial orchards, and thus participate in the program, also helps to explain the outcome.

Figure 5.7
Parcel & Property Tax Contributions – 2010
By Regional District



The annual property value tax requisition sent by the *SIR Program* to the regional districts is, in turn, allocated by the regional districts among their own participating electoral areas and municipalities. Each regional district allocates costs on the basis of converted assessment (land only). Figure 5.8 shows the approximate 2010 tax impact on a typical residential property for a sampling of municipalities.

Figure 5.8
Approximate Tax Impact on Typical Residence – 2010
Various Municipalities

Municipality	Residential Assessment (Land Only)	SIR Property Tax Payment
Penticton (RDOS)	$ 150,000	$ 7.00
West Kelowna (RDCO)	$ 225,000	$ 10.25
Kelowna (RDCO)	$ 250,000	$ 11.25
Vernon (RDNO)	$ 175,000	$ 8.50
Coldstream (RDNO)	$ 200,000	$ 9.50
Salmon Arm (RDCS)	$ 125,000	$ 6.00

CHAPTER 6
PROGRAM RESULTS TO DATE

The goal for the *SIR Program* is to control the codling moth population to a level at which damage from the pest was less than 0.2% of harvested fruit on at least 90% of all commercial acreage for the program area as a whole. Figure 6.1 illustrates that the *Program* overall has achieved that level of control.

Within the service area, Zone 1 had both the largest number of acres under production, and the largest number of acres with low codling moth damage. Zones 2 and 3 performed slightly less well — a result that is explained in part by the fact that sterile insect release did not begin in these zones until 2003.[5] Figure 6.2 shows the 2010 results, along with those from previous years, as far back as 2005.

Figure 6.1
Percent of Acreage Less than or Equal to 0.2% Codling Moth Fruit Damage, 2005 to 2010

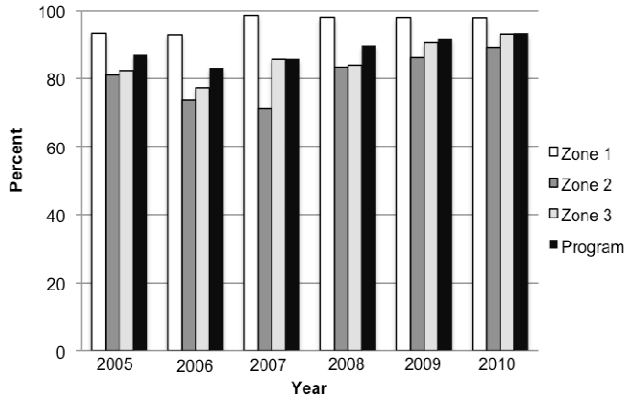


Figure 6.2
Results To Date Each Year — 2005 to 2010
Percentage of Acreage with Codling Moth Damage

	ZONE 1			ZONE 2			ZONE 3			***TOTAL***		
YEAR	***Low***	***Med.***	***High***	***Low***	***Med.***	***High***	***Low***	***Med.***	***High***	***Low***	***Med.***	***High***
2005	93.3	4.3	2.4	81.0	6.4	12.6	82.3	9.7	8.1	87.1	6.0	6.9
2006	92.9	3.4	3.7	73.5	9.2	17.3	77.4	14.4	8.3	83.1	7.5	9.4
2007	98.5	0.6	0.9	71.2	13.1	15.7	85.8	9.0	5.2	85.9	6.9	7.2
2008	98.0	1.4	0.7	83.5	7.7	8.8	84.1	12.8	3.1	89.8	6.0	4.2
2009	97.9	0.6	1.5	86.2	5.5	8.2	90.6	5.7	3.7	91.9	3.6	4.5
2010	97.8	1.2	1.0	89.2	4.5	6.3	93.1	2.2	4.6	93.4	2.7	3.9

Low = Less than or equal to 0.2% damage
Med. = Between 0.2% and 0.5% damage
High = Greater than 0.5% damage

[5] In Zone 2 codling moth populations today are concentrated in specific areas within the zone. These concentrations make the numbers look less positive for the zone as a whole.

Program success requires careful attention to urban areas that contain host trees. Figure 6.3 presents urban site data from 2001 and from 2010. The data point to some key findings:

Figure 6.3
Urban Site Comparison — 2001 and 2010
Total Area

Year	Total Active	Total BZ* Active	Total with CM	Total BZ* with CM
2001	16015	5163	5794	2032
2010	12320	3336	709	406

* Buffer Zones

- The total number of urban properties with host trees — that is, total active sites — decreased from 16,015 in 2001 to 12,320 in 2010.

- Of these 12,320 active urban sites in 2010, 709 recorded some level of codling moth activity (which may be as little as one larva). Put differently, urban sites with any level of codling moth activity in 2010 represented 5.8% of all active urban sites. In 2001, the figure was 36.2%.

- The total number of active urban properties located specifically within a buffer zone (BZ) — that is, within 200 metres of an orchard — dropped from 5,163 in 2001 to 3,336 in 2010 — a reduction of 35%.

- Of the 3,336 active urban sites within buffer zones in 2010, 406 recorded some level of codling moth activity — 12.2%. In 2001, the figure was 39.4%.

Changes in wild moth captures are one other measure that can be used to gauge *Program* results. As part of the *Program's* ongoing monitoring efforts, thousands of pheromone traps are placed in commercial orchards to detect moth presence. A lower codling moth presence helps to reduce the potential for crop damage.

For each of the three zones, Figures 6.4 (a) and 6.4 (b) on the following page compare the average number of codling moth captures in orchards, per trap, per week, in 2004 and 2010 respectively. On average, codling moth population levels have dropped between 2004 and 2010. In 2010, population levels were well below the recommended action threshold that would warrant growers to move to the use of cover sprays. The action threshold is currently two moths per trap, per week, for two consecutive weeks. Prior to the start of the *Program*, the average weekly trap capture was above two in most areas. Figures 6.4 (a) and 6.4 (b) also show that population levels are becoming more uniform across the *Program* area, but that more effort is needed in Zones 2 and 3 in order to reach Zone 1 levels.

Figure 6.5 shows the average number of wild codling moths caught per trap over the 16- to 18-week trapping period in 1999 and 2010. The data show, on average, a dramatic reduction in the wild codling moth population. Levels have dropped to sub-economic levels as a result of sterile moth release. There are, however, still some high populations that require continued vigilance and control effort. The low levels have allowed the *Program* to evaluate the performance of mating disruption technology as an expanded pilot project for an area-wide control tactic in Zones 2 and 3 in the year 2011.

Figure 6.4 (a)
Average Number of Wild Codling Moth Captures per Trap, per Week – 2004

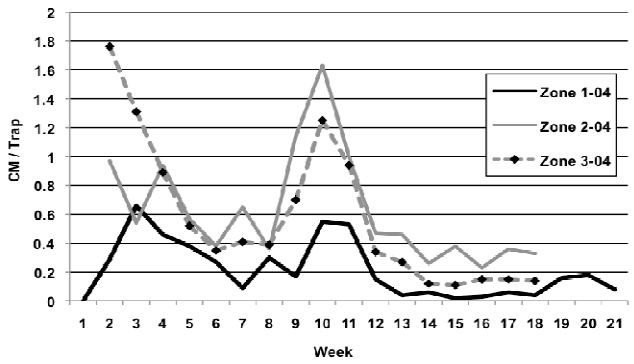


Figure 6.4 (b)
Average Number of Wild Codling Moth Captures per Trap, per Week – 2010

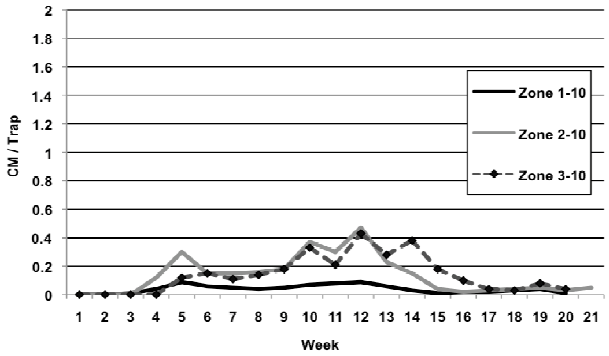
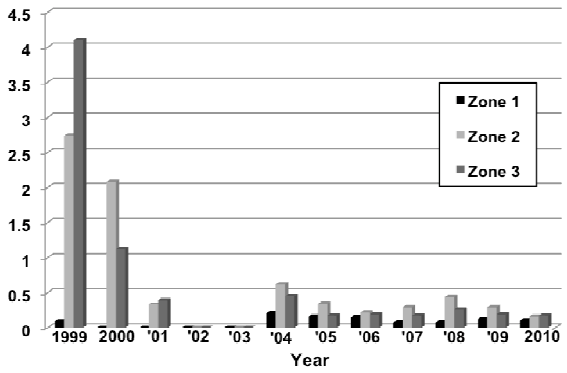


Figure 6.5
Average Number of Wild Moths Captures per Trap, per Week, per Season – 1999 to 2010*



* Sterile moth release began in1994 in Zone 1. Release began in Zones 2 and 3 in 2002.

CHAPTER 7
BENEFITS OF THE PROGRAM

Since the introduction of the *SIR Program* in 1992 there has been a significant reduction in the number of codling moths, the level of codling moth damage, and the amount of organophosphate pesticides that would have otherwise been required to control moth infestations. In contributing to these successes, the *Program* has produced many different benefits for growers, the broader community, and the natural environment.

Categorizing benefits by type is a difficult undertaking since many individual benefits cut across category lines. In broad terms, however, benefits can be viewed as either socio-environmental or economic in nature.

SOCIO-ENVIRONMENTAL BENEFITS

Examples of benefits that may be characterized as social and/or environmental include the following:

- *Good Urban-Rural Relations* — The area covered by the *SIR Program* is a high growth region of the country — thousands of new residents move into area each year to enjoy its quality of life. Growth pressures result in more people building homes and related uses (e.g., schools) in relatively close proximity to orchards. The potential for conflict between residents and growers can be significant.

  The *SIR Program* helps to reduce this potential. For residents, the growers' use of sterile insect technology in place of large doses of chemical pesticides helps to allay fears that such chemicals pose. Spray drift is minimized and orchard aesthetics are improved. For growers, the *Program's* efforts to educate homeowners and eliminate urban host trees as sources of codling moth infestation provide great comfort. Growers also know that residential properties that have been targeted and cleaned-up through the *Program* are made less susceptible to infestations from other pests, such as leaf rollers.

- *Minimization of Pesticide Risks* — A desire to significantly reduce the volume of chemical pesticides in use was a major impetus for the establishment of the *SIR Program*. The latest pesticide sales figures from BC's Ministry of Environment suggest that the volume of organophosphate pesticides used in the *Program's* service area has indeed fallen sharply. In 2008, sales of organophosphate pesticides in all zones combined were 93% below sales in

1991. Put differently, 44,000 fewer kilograms — or 97,000 fewer pounds — of organophosphate pesticides were purchased in 2008 than in 1991.[6]

It should be recognized that organophosphates and others types of pesticides are approved by senior governments in Canada, the United States and elsewhere for use in efforts aimed at controlling the codling moth.[7] As with many other types of pesticides, however, organophosphates present the lowest risk to health and the environment when used in limited quantities.

Organophosphates and other pesticides are also more acceptable to the public when used in limited quantities. Public perceptions surrounding the use of chemical pesticides are very powerful and cannot be ignored. In plain terms, the broader community perceives chemical sprays to be dangerous. The widespread and heavy use of chemical agents, particularly where alternatives such as SIT exist, is rejected by the public. If the *SIR Program* were ended tomorrow, growers would be forced to make greater use of a range of control methods, including pesticides. Volumes of chemical sprays in use would almost certainly escalate.

It is worth noting, finally, that the *SIR Program's* success in moving towards program sustainability means that growers in most cases will be able to replace organophosphates in their integrated pest management programs with less toxic alternatives.

- *Protection of Bio-diversity* – BC's Southern Interior boasts some of the highest bio-diversity in Canada. Many insects, mammals (e.g., bats) and other animals exist in orchard ecosystems to help control the number of codling moths. When left alone, these "beneficials" as they are known can do their jobs. Sterile insect technology succeeds in leaving the beneficials alone and unharmed. One of the advantages of SIT is that it is able to zero-in on its intended target (the codling moth) without causing significant collateral damage to other creatures. Broad-spectrum chemical sprays do not possess this trait.

[6] More recent figures for pesticide sales were not available at the time the *Guide* was prepared.

[7] Organophosphates are currently approved as restricted-use pesticides. They are in the process of being phased-out by senior government regulators and will be no longer available for use in Canada or the United States after 2012.

ECONOMIC BENEFITS

Examples of benefits that are primarily economic in nature include the following:

- *Market Opportunities* — The *SIR Program's* success in minimizing codling moth populations has positioned the tree fruit industry to expand existing markets, and create new markets, for BC fruit. The BC Fruit Growers' Association is currently in the process of developing an application to the Canadian Food Inspection Agency to have the SIR service area designated an *Area of Low Pest Prevalence* (ALPP) for codling moth. Designation would enable apple and pear growers to more easily comply with importation requirements that apply in certain jurisdictions. Compliance would, in turn, provide access to markets in those jurisdictions.

  Commercial pome fruit harvests in the service area account for the lion's share of the Interior's tree fruit industry. Overall, this industry represents 800 growers, operating orchards that generate $130 million in annual wholesale revenue and $900 million in annual economic activity. An ALPP designation for the area — a designation made possible by the success of the *SIR Program* — would only strengthen the industry and help it contribute more to the regional economy.

- *Economic Sustainability* — The *Program's* success in minimizing pesticide use has enabled growers throughout the area to produce high quality, clean and wholesome fruit. Consumers in the markets supplied and targeted by BC's fruit growers are becoming increasingly health- and environmentally-conscious. As this trend continues, fruit products that do not require heavy applications of pesticides will be in high demand. Strong demand for such products will help BC's fruit industry to become more economically sustainable.

  It is worth noting that the low use of pesticides has also helped to facilitate the development and growth of the Southern Interior's organic fruit sector. A broader-based industry that includes strong conventional and organic components may also promote economic sustainability. And, enhanced sustainability for the industry helps the broader economy in the region.

- *Reduction in Loss* — Damaged fruit represents a potential cost in terms of lost sales. Under the *SIR Program*, fruit loss to codling moth damage has been minimized. Indeed, the level of damage has been reduced significantly from earlier times when growers were forced to rely more heavily on pesticides to control moth infestations.

- *Impact on Tourism* — Tourism is a major and growing part of broader regional economy. Tourists are drawn to the area by a variety of amenities including climate, the lakes, outdoor recreational opportunities and the

natural environment. The area's landscape is particularly distinctive and attractive to visitors. The growing number of wineries are one feature of the landscape; so, too, are the region's many orchards (as they have been for over 100 years). The rows of apple, pear and other fruit trees on sloping hillsides are quintessential elements of the Okanagan, Similkameen and Shuswap regions.

The appeal of the orchards — and, by extension, the broader area — is enhanced by the minimal use of chemical pesticides, and the high quality fruits that are produced. The *SIR Program* has contributed, and continues to contribute, to this appeal. The *Program* promotes environmental values which are shared by increasing numbers of visitors.

It is worth noting that many of the outdoor recreational opportunities that draw tourists to the area are more appealing than they would otherwise be thanks in part to the *SIR Program*. Golf, eco-tourism activities, agro-tourism activities, bird watching, and a variety of water sports all benefit from the clean environment — and the *perception* of a clean environment — that the *SIR Program* helps to promote.

OTHER BENEFITS

Not all benefits can be made to fit into one of the two previous categories. Consider the advancement of science.

- *Advancement of Science* — The *SIR Program* contributes to the reputation of the region as a centre of excellence in horticultural research and innovation. The *Program* generates interest from scientists and others in many different countries. Each year, international scientists pay to attend an SIR training program at the rearing facility in Osoyoos to learn the principles and procedures of an area-wide pest management program focused on SIT. Information from the *SIR Program* is now being applied in places such as the United States, Argentina, Chile, Brazil, South Africa, Morocco, Tunisia and Pakistan — all countries that are developing, or that are interested in developing, their own SIT-based strategies.

  Within the Southern Interior, the experience gained through the *SIR Program* has enabled scientists to learn more about the local environment. The vast amounts of data and knowledge that have been accumulated over the years can be applied to the development of other clean initiatives.

CHAPTER 8
FUTURE OF THE SIR PROGRAM

The *SIR Program* has been in operation since 1992. Since this time, the *Program* has succeeded in helping to control the codling moth population, and in significantly reducing the volume of organophosphate pesticides in use.[8] The *Program* is not without its challenges. Decision-makers will need to face these challenges in the coming years. Certain opportunities also exist for decision-makers to pursue.

CHALLENGES

A constant challenge is the need to maintain support among all stakeholders for a continuing *SIR Program*. Growers and local elected officials, in particular, need to be convinced of the *Program's* broad value, and of the fairness of the *Program's* approaches to cost-recovery and -allocation. Continued progress in Zones 2 and 3 may help in promoting the *Program's* value. Greater recognition and realization of the benefits to both growers and the general public may settle concerns related to the equitability of the *Program's* funding arrangements.

The cost of operating the rearing facility in Osoyoos is another challenge facing the *Program*. About 24% of the $3 million budget in 2010 was required to keep the facility running. Options to economize are difficult to pursue since many of the facility's costs are fixed in nature.

Questions about the value of SIT as the core element of an integrated pest management plan have been raised by growers. These questions are now being explored by scientists and researchers associated with the *Program*, in part through a three-year pilot project. The results of the pilot project will help stakeholders determine what changes are needed, if any, to ensure that the *Program* remains an effective and cost-effective area-wide strategy for control of the codling moth. The results may also have implications for the rearing facility in Osoyoos, and the significant investment to date in SIT development.

A separate challenge relates to the lack of effective controls over fruit bin movements — controls that are required to ensure that bins which are infected with codling moth larvae do not enter the service area and cause infestations to occur. The *Program* does not have the authority, at present, to regulate bin movements.[9]

[8] It is important to note, again, that some growers in parts of the SIR service area continue to use chemical sprays, in addition to SIT, to help control the codling moth. Most growers that do spray, however, have moved (or are moving) from organophosphates to other less toxic chemicals.

[9] As noted earlier, the *Program* does have broad authority to clear properties of codling moth infestations. It could be argued that under this authority *SIR* officials have the power to clear all infested items from properties, including fruit bins. To date, this argument has not been tested.

Lack of clarity surrounding the question of withdrawal from the *Program* by municipalities and electoral areas within participating regional districts is a further challenge. SIR officials are looking to the province to respond to the issue in a way that balances an individual jurisdiction's wishes with the *Program's* need to remain effective.

One final challenge concerns the ongoing loss of pome fruit acreage in the service area. Since the beginning of the *Program* in 1992, thousands of acres of apple and pear orchards in the Okanagan, Similkameen and Shuswap have been converted to other uses. In the coming years, further losses are expected. The continual loss of acreage risks a decline of parcel tax revenue to the *Program*. Such loss may also, ultimately, threaten the economic sustainability of the fruit industry and its important role in the regional economy.

OPPORTUNITIES

As suggested in the previous Chapter, experience under the *SIR Program* has helped scientists (and growers) accumulate a considerable amount of knowledge about local growing environments, and about the conditions for success associated with alternative pest control methods. There may be opportunities to apply this knowledge to other fruit crops and other pests.

Opportunities to sell expertise and materials (e.g., sterile insects) may also exist. In 2008, codling moth egg sheets were sold to a private company that produces bio-control products; and in years prior, other jurisdictions experimenting with SIT use have purchased materials produced at the facility. In addition, as noted earlier, scientists from several countries regularly pay to attend SIR training sessions in Osoyoos. Revenues from increased sales of expertise and materials may help to relieve financial pressure on the rearing facility and the *Program* as a whole.

Fruit marketing opportunities possible with an ALPP designation, and from the growing recognition of low pesticide use, may be considerable. Such opportunities, if realized, would benefit growers and the fruit industry, but would also benefit the broader economy and community.