

GASTROPOD SURVEYS OF THREE CREEKS APRIL 2018-MARCH 2020



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Introduction

Species Information: Oregon Forestsnail

The Oregon forestsnail (*Allogona townsendiana*) is a large terrestrial snail endemic to western North America. The slightly flattened shell of this species varies in colour from light brown to straw yellow and has a diameter of 28-35 mm as an adult (Figure 1). The outer layer of the shell can become bleached and flake off with age. A thickened whitish apertural lip distinguishes this species from other large land snails such as the Pacific sideband snail (*Monadenia fidelis*) and grove snail (*Cepaea nemoralis*) (Oregon Forestsnail Recovery Team; OFRT 2012).

The Oregon forestsnail is found in the Coastal Douglas-fir (CDF) and Coastal Western Hemlock (CWH) biogeoclimatic zones, occupying mixed and deciduous forest habitat. Canopy cover is typically composed of bigleaf maple (*Acer macrophyllum*), black cottonwood (*Populus trichocarpa*) and scattered western red cedar (*Thuja plicata*) (BC Conservation Data Centre 2017). Occasionally, the Oregon forestsnail is found using a combination of meadow and forest habitat (Edworthy et al. 2012). Soft and insulating soil is required for nesting and cover habitat (Steensma et al. 2009). There is also a strong association with stinging nettle, as it provides an important source of calcium and other minerals necessary for shell growth, and its presence is also an indicator of the moist environment preferred by the Oregon forestsnail (OFRT 2012). In addition, coarse woody debris is often associated with occurrences of the species (Steensma et al., 2009; Edworthy et al. 2012).

The Oregon forestsnail is hermaphroditic but is unlikely to self-fertilize (OFRT 2012). Mating season ranges from February to June peaking in March and April. Eggs are laid in small depressions dug into the substrate and one study calculated an average clutch size of 34 eggs. Juveniles hatch 8-9 weeks after oviposition and begin dispersing immediately. In dry conditions this species goes into aestivation to conserve moisture. During the cold winter months, the Oregon forestsnail burrows into leaf litter or retreats under coarse woody debris and hibernates (Steensma et al. 2009). A study completed on a population in Langley, British Columbia, shows that they have low dispersal ability. The maximum distance moved by a snail in one day was 4.5 m and home ranges ranged from 18 to 404 m² (Edworthy et al. 2012).

The Oregon forestsnail is considered endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and is listed under Schedule 1 as endangered by the *Species at Risk Act* (SARA). The BC conservation data center identifies this species as red-listed (BC Conservation Data Centre 2017). The habitat requirements of the Oregon forestsnail overlaps with the most densely populated and developed areas of British Columbia. Habitat loss and degradation due to commercial and residential development poses the most serious threat to this species. Remaining suitable habitat occurs in small isolated patches. The effects of genetically isolating populations are currently unknown (OFRT 2012).

Recreational activities such as mountain biking and hiking also threaten the Oregon forestsnail habitat through soil compaction and trampling. Introduced invertebrates may threaten this species by competing for resources, such as food and shelter, and predation. Invasive plants can also be deleterious to Oregon forestsnail habitat by changing vegetation structure in ways that may reduce moisture retention in the forest. These invasive plants may also outcompete native vegetation important to the life cycle of this species, including stinging nettle (OFRT 2012).

Land snails such as the Oregon forestsnail provide important ecological functions as decomposers of live and decaying plant matter (OFRT 2012) and dispersal of seeds and fungal spores (Edworthy et al. 2012). A better understanding of this unique species will allow for more informed and effective conservation efforts.



Figure 1: Adult Oregon forestsnail. Note the shell has become bleached and flaky with time and the thickened whitish apertural lip.

Species Information: Pacific Sideband

The Pacific sideband (*Monadenia fidelis*) is a large land snail that occurs along the west coast of North America. The slightly flattened shell of this species has a diameter of 22-36 mm and is brown with a yellow band around the outer whorl. In some cases, this species can also be blond in colour with faint banding (Figure 2). The apertural lip of this species is slightly thickened and is dark brown in colour, unlike the white apertural lip of the Oregon forestsnail. A distinguishing feature of this species is the rosy brown colour and rough texture of the animal's body (Forsyth 2004). The Pacific sideband snail is hermaphroditic and inserts tiny projectiles covered in hormonal mucus prior to mating to improve sperm survival (Zevit et al. 2012).

The Pacific sideband occurs from northwestern California to British Columbia with an unverified detection in Sitka, Alaska (Forsyth, n.d.). In British Columbia, the Pacific sideband occurs in the Coastal Douglas-fir (CDF) and Coastal Western Hemlock (CWH) biogeoclimatic zones extending as far north as the Central Coast Regional District. The species occurs in deciduous, coniferous or mixed forests as well as open woods and grassy areas. This snail is often found climbing trees and has been found as high as 6.7 m above ground (BCCDC 2014; Forsyth 2014).

In 2016, the Pacific sideband was down-listed from special concern (blue-listed) to apparently secure (yellow listed) by the BC Conservation Data Center. This species is not ranked by COSEWIC or SARA. However, the species is negatively affected by habitat loss and degradation caused by residential and commercial development, agriculture, and forestry (BC Conservation Data Centre, 2016). There are several significant gaps in our knowledge of this species. A better understanding of the habitat requirements of the Pacific sideband will help with its conservation efforts and ensure its distribution and abundance remain stable. Hence, irrespective of the down listing we continued to include Pacific sidebands in our mark-recapture study, our goal is to generate valuable long-term data that will help us understand the longevity and habitat requirements for this species.



Figure 2: Adult Pacific sideband. Note the yellow band around the outer swirl and the rosy brown colour and rough texture of the animal's body.

Goals and Objectives

In 2014, a mark-recapture study was implemented on the Three Creeks conservation property owned by the Fraser Valley Conservancy (FVC). This study is intended to increase our knowledge of the at-risk gastropod species occurring on this property and to monitor these snail populations. Surveys have been repeated annually, except for the spring of 2019.

The objectives of this project are:

- To provide baseline data on the populations of Oregon forestsnail and Pacific sideband occurring on the Three Creeks property;

- To determine where on the property the snail species occur, and which habitats are being utilized;
- To estimate the population size of the Oregon forestsnail and Pacific sideband as well as survival rate and longevity; and
- To identify optimal times of year for Oregon forestsnail surveys and detectability.

Study Area

The FVC's Three Creeks property is located on the south side of McKee Road, across the street from Ledgeview Golf Course, in Abbotsford, BC. Access to the property is through a gate located at the east end of Ledgeview Drive. This property was donated to the conservancy in 2013, with 0.2-acre addition in 2017, the current size totals 8 acres.

The parcel consists primarily of mixed forest habitat on a north facing slope of McKee Peak (on Sumas Mountain). Three creeks flow through the site which is dominated by mature cedar, bigleaf maple, sword fern and stinging nettle vegetation. The property provides valuable habitat for many species, including amphibians, mammals, songbirds and raptors. It is also home to several species at risk including Oregon forestsnail, mountain beaver, Northern red-legged frog and possibly Pacific water shrew. The property is nestled between housing developments (existing and pending) but connects directly to natural habitat to the south providing an important corridor for wildlife. The FVC's long-term objective is to monitor and manage the property to ensure it remains a valuable ecological resource to the community in perpetuity.

The property is located in the Coastal Western Hemlock, Dry Maritime (CWHdm) biogeoclimatic subzone within the Georgia Depression Ecoprovince of the Lower Mainland Ecoregion and the Fraser Lowland Ecoregion.

Methods

Surveys were conducted following draft Oregon forestsnail mark-recapture and monitoring study protocols (Heron 2018) and amended to suit the amount of time and funding allocated to this project (see Appendix A). Due to low mark-recapture rates in previous years we decided, in consultation with Jennifer Heron, to do two spring surveys when the snails are most active and one fall survey.

From April 2018 until July 2019 this project work had no funding support. FVC staff endeavoured to complete the surveys as intended in 2018 but this was not possible for the spring 2019 surveys. Likewise, there was no report generated for the 2018 season, therefore this report reflects the surveys and findings from April 2018 until April 2020.

In 2018, the surveys were conducted on the following dates: 3rd and 30th of May, and 26th of October. In 2019, there was only one fall survey on October 23rd. A total of 19 permanent survey plots are located throughout the Three Creeks property. Plots are marked with 2' rebar and flagging tape. UTM coordinates were recorded for each plot as well as aspect, slope, overstory species, slope position, time,

surveyor initials, and soil comments. A category was recorded for moss cover, amount of coarse woody debris, type of light at snail level, moisture level, and disturbance (Appendix A).

At each location a 5 m radius survey area was delineated using marking flags and/or flagging tape. A total of 20-person minutes (6 minutes and 20 seconds with three surveyors; 5 minutes with four surveyors) were spent searching the plot for all gastropod species. Surveyors sifted through leaf litter, searched under vegetation, and examined logs and tree trunks. All specimens were placed in a surveyor specific bowl for later identification to minimize interruption of search time.

Following the search, all gastropod species were identified and recorded. Live and dead specimens were distinguished. Oregon forestsnail and Pacific sideband were measured using calipers (Canadian Tire Plastic Calipers) and given a unique number identifier. Marked snails were numbered consecutively by species using nail polish. Live snails were returned to where they were found. Empty shells were left at the center of the plot.

Transects were walked between survey plots and any incidental sightings of Oregon forestsnails and Pacific Sidebands were identified. Incidental snails and shells were marked and measured then left where found after the GPS position of the site was recorded.

Results

2018

Surveys of the Three Creeks property covered 4.7% of the 8 acres. In total 380-person minutes were spent searching in each of the two spring and the one fall survey sessions (1140 person minutes total in 2018). Overall, 259 gastropods were identified in survey plots (122 live; 137 dead). In total nine Oregon forestsnails and 17 Pacific sidebands were identified.

Spring Surveys 2018

The spring surveys were conducted on May 3rd and 30th, and in total 183 gastropods were identified (73 live; 110 dead) within plots. See Table 1 for a list of species and numbers identified. The average number of gastropods per plot was 9.6 for the May 3rd survey and 3.6 for May 30th (n=19). Six dead Oregon forestsnails and 15 Pacific sidebands (8 live, 7 dead) were detected within plots. 46 Oregon forestsnails and 20 Pacific sidebands were detected incidentally between plots (Figure 3).

Table 1: Gastropod species identified, numbers found dead and alive, and the number of plots containing each species for spring surveys in 2018.

Common Name	Scientific Name	# Alive	# Dead	Total	% plots	Avg/plot
Oregon forestsnail	<i>Allogona townsendiana</i>	0	6	6	21	0.3
Pacific sideband	<i>Monadenia fidelis</i>	8	7	15	37	0.8
Lancetooth	<i>Haplotrematidae family</i>	36	71	107	89	5.6
Chocolate arion	<i>Arion rufus</i>	0	0	0	0	0
Northwest hesperian	<i>Vespericola columbianus</i>	26	24	50	84	2.6

Grove snail	<i>Cepaea nemoralis</i>	0	2	2	5	0.1
Pacific banana slug	<i>Ariolimax columbianus</i>	3	0	3	11	0.2

The average size of alive Oregon forestsnails found, including incidental observations (n=35), was 26.3 mm while the average size for alive Pacific sidebands (n=10) was 32.0 mm. Table 2 details the minimum, maximum and average sizes of these species.

Table 2: Average measured size of Oregon forestsnail and Pacific sideband for alive and dead specimens found for spring surveys in 2018.

	Average Size (mm)	SD	Minimum (mm)	Maximum (mm)
Alive Oregon forestsnail (n=35)	26.3	5.1	12.8	30.0
Dead Oregon forestsnail (n=11)	28.0	0.6	27.5	29.1
Alive Pacific sideband (n=10)	32.0	1.9	28.3	34.0
Dead Pacific sideband (n=10)	31.3	5.2	22.3	35.4

Alive and dead Oregon forestsnails and Pacific sidebands have been found throughout the property. However, except for one dead Pacific sideband just south of plot 19, all other detections were in the southern half of the parcel in the spring of 2018 (Figure 3).

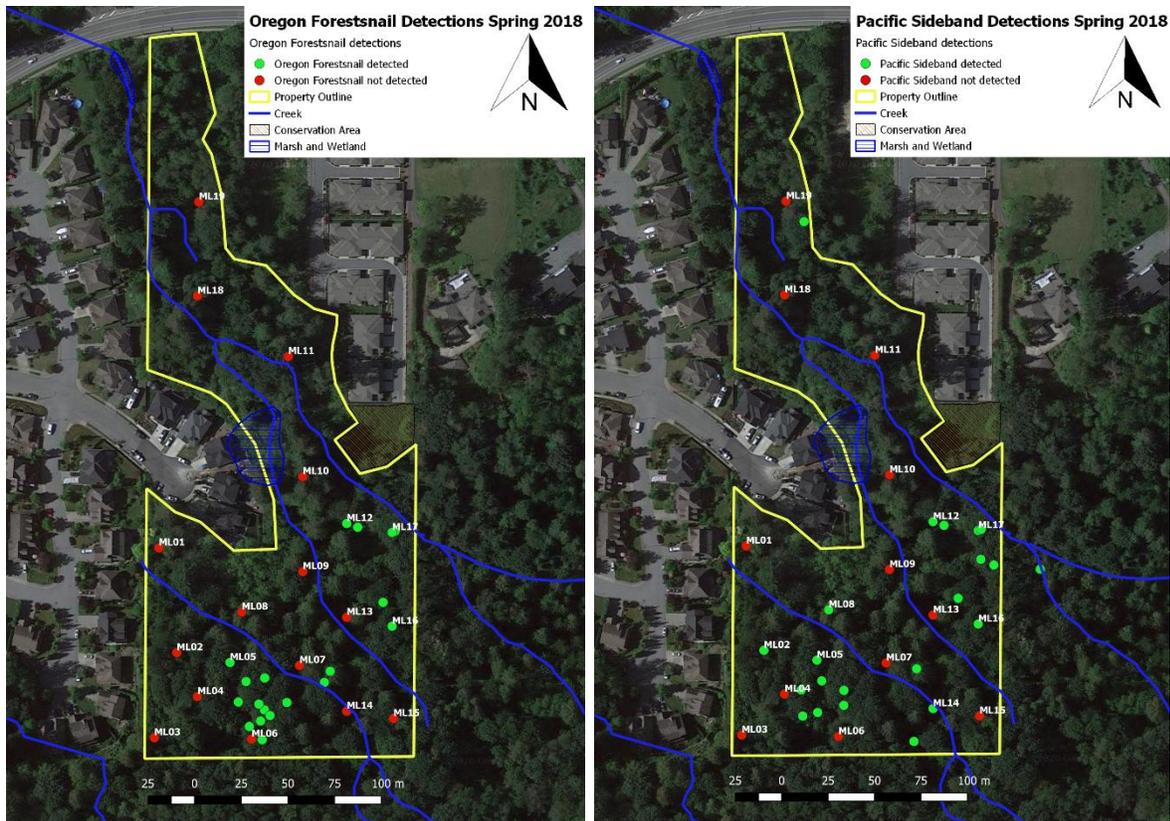


Figure 3: Maps showing locations of Oregon forestsnail and Pacific sideband detections from the 2018 spring surveys. Projection: UTM NAD 1983. Data compiled from the Fraser Valley Conservancy and the City of Abbotsford.

Fall Surveys 2018

The fall survey was conducted on October 26, and in total, 76 gastropods were identified (49 live; 27 dead) during the survey. See Table 3 for a list of species and numbers identified. The average number of gastropods per plot was four ($n=19$). Three dead Oregon forestsnails and two Pacific sidebands (1 live, 1 dead) were detected. There were no incidental sightings of Pacific sidebands or Oregon forestsnails between the plots (Figure 4).

Table 3: Gastropod species identified, numbers found dead and alive, and the number of plots containing each species for fall surveys 2018.

Common Name	Scientific Name	# Alive	# Dead	Total	% plots	Avg/plot
Oregon forestsnail	<i>Allogona townsendiana</i>	0	3	3	11	0.2
Pacific sideband	<i>Monadenia fidelis</i>	1	1	2	11	0.1
Lancetooth	<i>Haplotrematidae</i> family	25	20	45	84	2.4
Chocolate arion	<i>Arion rufus</i>	0	0	0	0	0
Northwest hesperian	<i>Vespericola columbianus</i>	22	3	25	68	1.3
Grove snail	<i>Cepaea nemoralis</i>	0	0	0	0	0
Pacific banana slug	<i>Ariolimax columbianus</i>	1	0	1	5	0.5

The dead Oregon forestsnails found in plot 4 and 17 were in too poor condition to measure. While the alive Pacific sideband, found underneath leaf litter in plot 12, measured 32.5 mm. The dead Pacific sidebands at plot 6 measured 32.2 mm.

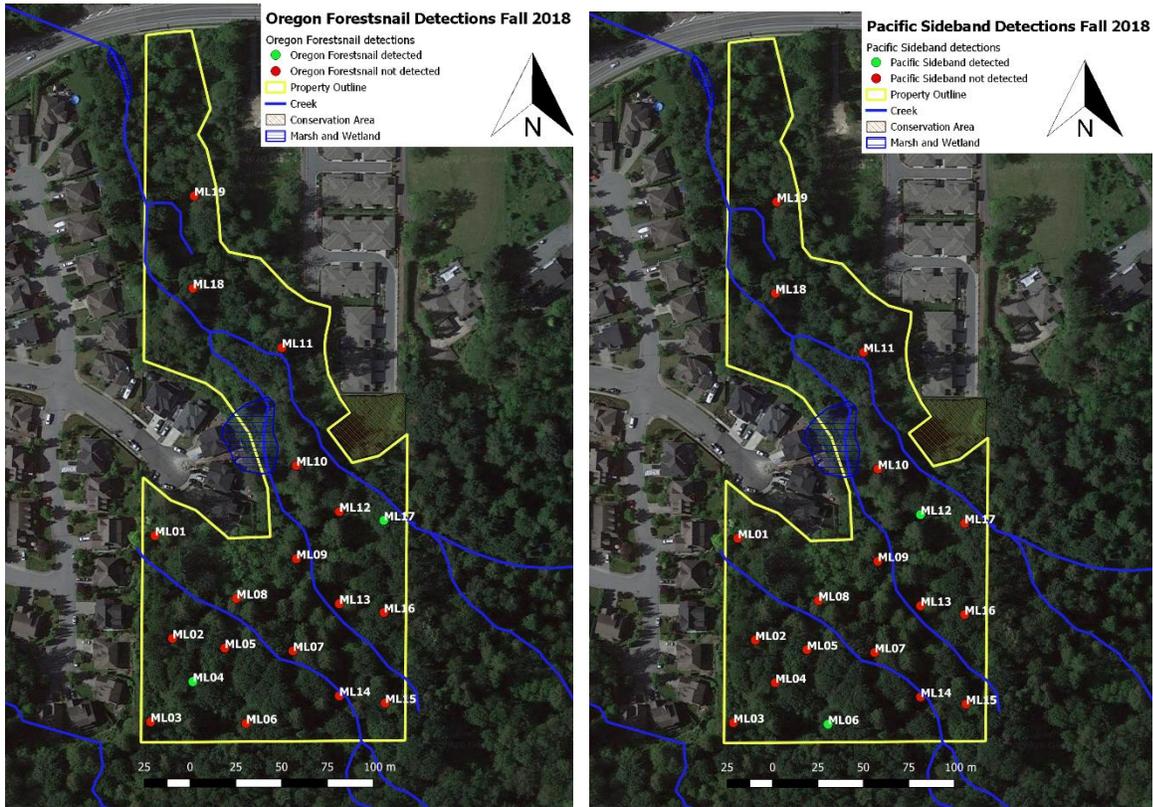


Figure 4: Maps showing locations of Oregon forestsnail and Pacific sideband detections from the 2018 fall surveys. Projection: UTM NAD 1983. Data compiled from the Fraser Valley Conservancy and the City of Abbotsford.

Fall Surveys 2019

There was no spring survey in 2019, due to funding limitations. However, funding resumed in time for our fall survey which was conducted on October 23. In total, 69 gastropods were identified (43 live; 26 dead) during the survey. See Table 4 for a list of species and numbers identified. The average number of gastropods per plot was 3.6 (n=19). One alive Oregon forestsnailed and one dead Pacific sideband were detected. There were no incidental sightings of Pacific sidebands or Oregon forestsnailed snails between the plots (Figure 5). However, the alive Oregon Forestsnail found in plot 4 was a recapture for the second time. Originally marked May 3rd, 2018 between plots, the snail was first recaptured on May 30th 2018, also between plots

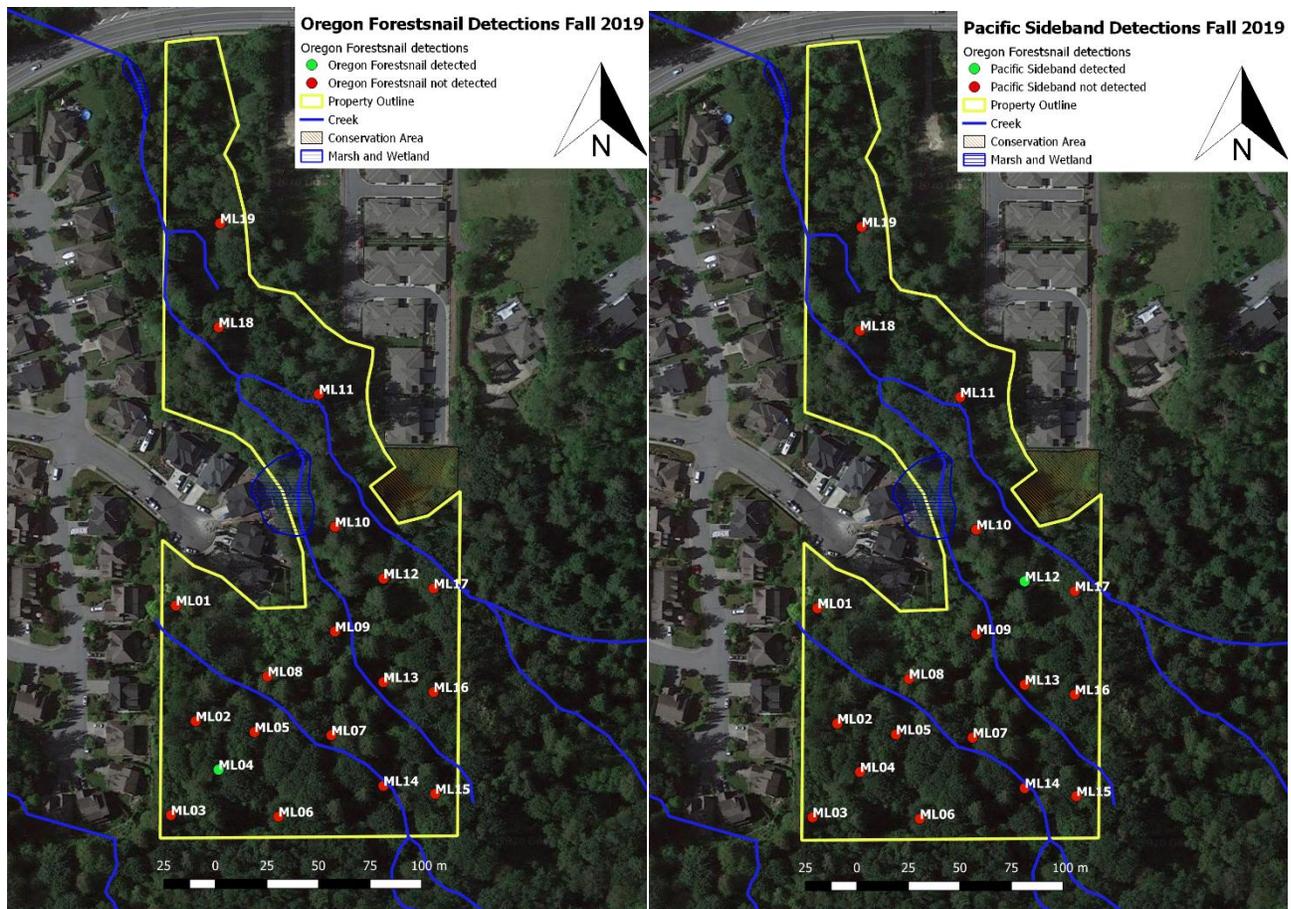


Figure 5: Maps showing locations of Oregon forestsnailed and Pacific sideband detections from the 2019 fall surveys. Projection: UTM NAD 1983. Data compiled from the Fraser Valley Conservancy and the City of Abbotsford.

Table 4: Gastropod species identified, numbers found dead and alive, and the number of plots containing each species for fall surveys 2018.

Common Name	Scientific Name	# Alive	# Dead	Total	% plots	Avg/plot
Oregon forestsnail	<i>Allogona townsendiana</i>	1	0	1	5	0.5
Pacific sideband	<i>Monadenia fidelis</i>	0	1	1	5	0.5
Lancetooth	<i>Haplotrematidae</i> family	28	19	47	79	2.5
Chocolate arion	<i>Arion rufus</i>	0	0	0	0	0
Northwest hesperian	<i>Vespericola columbianus</i>	14	3	17	53	0.9
Grove snail	<i>Cepaea nemoralis</i>	0	3	3	10	0.16
Pacific banana slug	<i>Ariolimax columbianus</i>	0	0	0	0	0

Summary 2014-2018 Oregon Forestsnails

The total number of Oregon forestsnails found in 2015-2017 has been between 17 – 22 snails, which equates to one snail per plot (Table 4). Interestingly, in 2014 and 2018 we detected a total of 41 and 49 Oregon forestsnails, respectively, almost a doubling compared to previous years. The Oregon forestsnails are not found in uniform distribution across the site. The highest densities of snails have been found in the southern section of the parcel (Figure 6).

Table 5: Summary total number of Oregon forestsnails found per year during the spring and fall surveys (In brackets % alive).

Year	Spring	Fall	Total	% plots	Avg/plot
2014	35 (29%)	24 (17%)	59	58	3.1
2015	18 (83%)	3 (0%)	21	32	1.1
2016	10 (30%)	0	10	21	0.5
2017	3 (33%)	1 (0%)	4	16	0.2
2018	52 (67%)	3 (0%)	55	21	0.5
2019	NA*	1 (100%)	1	5	0.5

*46 of the Oregon forestsnails detected in the spring were found between plots.

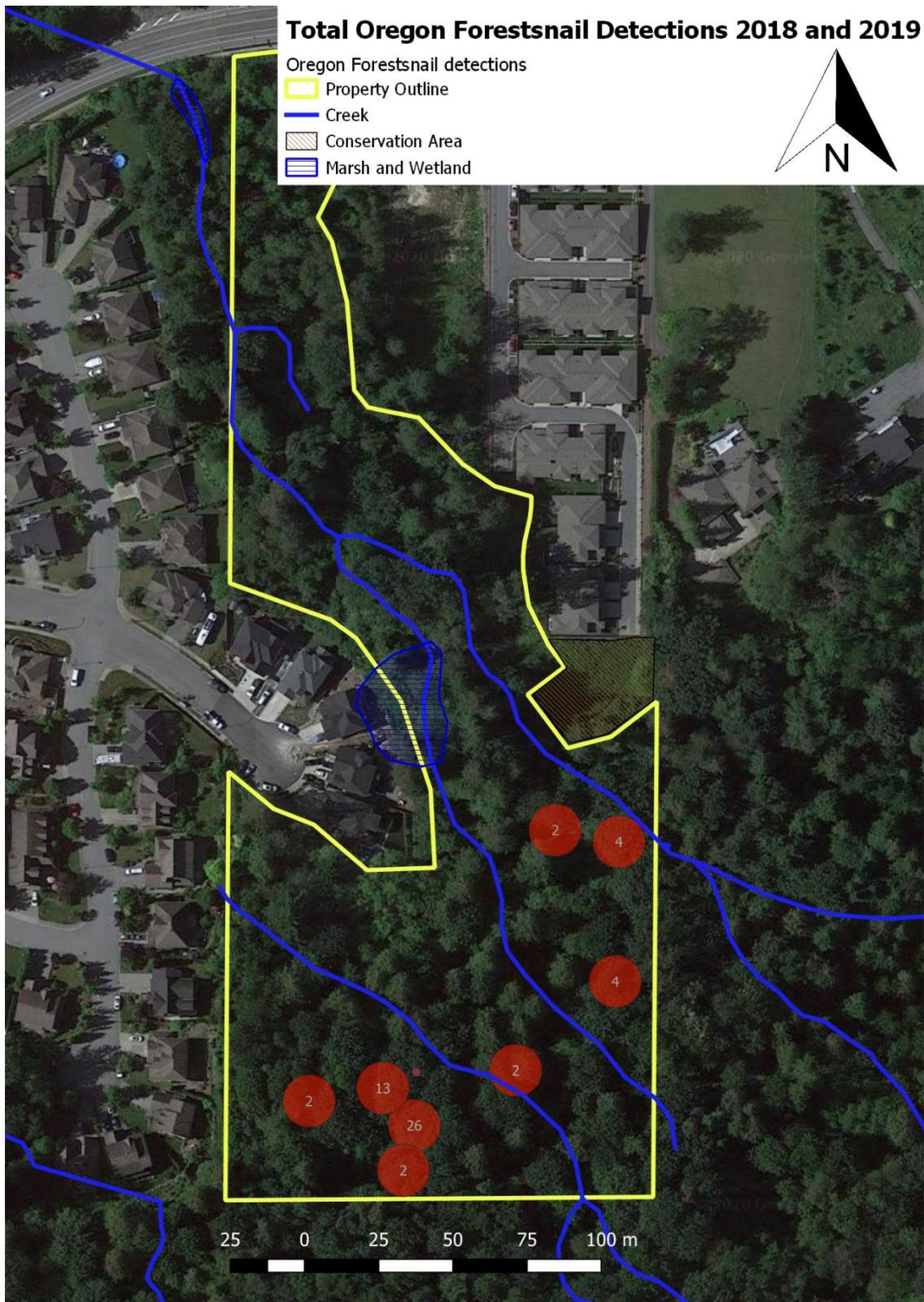


Figure 6: Clustering of Oregon Forestsnail detections (radius=20 m) showing the areas where the highest densities of Oregon Forestsnails were found at Three Creeks in 2018 and 2019. Projection: UTM NAD 1983. Data compiled from the Fraser Valley Conservancy and the City of Abbotsford.

Recapture Data Oregon Forestsnail and Pacific Sidenband

To date, we have marked 211 snails (131 Oregon forestsnails, 80 Pacific sideband snails) of which 13 snails have been recaptured, including one snail (214) that has been recaptured twice. Distance travelled between recaptures ranges from 0-76 m with the average being $22(SD\pm 21)$ m. Interesting to note that in 2018, three snails that were first marked on May 3rd in the same location were all found May 30th together 19 m southeast of the original location, all in aestivation. Similarly, two other snails that were originally found together on May 3rd were also recaptured together 14 m southeast of the original location, in aestivation. To date, the oldest recapture is an Oregon forestsnail (68) that was originally captured and marked May 29th, 2015 and was then recaptured three years later May 30th, 2018. Its shell had grown by 3.2 mm and the snail was found 5 m from the original capture location.

Table 6. Recapture data from our mark-recapture study 2014 – ongoing (n=211 snails), to date 13 snails have been recaptured.

Date	#	Sp	Shell Diam mm	Condition	Microhabitat	Recapture Date	Distance Travelled m	Microhabitat	Shell Diam mm	Condition	Comments
02-Apr-15	70	OFS	26.2	Alive	In nettle	29-May-15	58	Under sword fern		Dead	
29-May-15	70	PSB	32.7	Alive	NA	29-Oct-16	0	NA		Dead	
29-May-15	68	OFS	26.4	Alive	In nettle	30-May-18	5	Buttercup, fringecup, lady fern, maple, leaf litter, stinging nettle	29.6	Alive	
03-May-16	89	OFS	23	Alive	Pacific waterleaf	03-May-18	76	On leaf litter, nettle, salmon berry, Indian plum, ferns, shade	29.4	Alive	
03-May-18	204	OFS	28.3	Alive	On leaf litter, nettle, salmon berry, Indian plum, ferns, shade	30-May-18	19	NA	NA	Alive	204, 207, and 210 in same location on both dates, Recap: Aestivation.
03-May-18	207	OFS	28.8	Alive	Same as above	30-May-18	19	NA	NA	Alive	
03-May-18	210	OFS	27.6	Alive	Same as above	30-May-18	19	NA	NA	Alive	
03-May-18	213	OFS	28.6	Alive	NA	30-May-18	14	NA	NA	Alive	Old number non-eligible, added new number. 213 and 215 in same location on both dates, Recap: Aestivation
03-May-18	214	OFS	28.2	Alive	NA	30-May-18	11	On top of ladyfern	NA	Alive	2nd Recapture 23-Oct-19: underneath leaf litter close to fern and nettles, and in aestivation moved 22m.
03-May-18	215	OFS	26.6	Alive	NA	30-May-18	14	Underneath leaf litter	NA	Alive	
03-May-18	217	OFS	28.5	Alive	NA	30-May-18	24	NA	NA	Alive	
03-May-18	219	OFS	26.8	Alive	NA	30-May-18	19	buttercup, fringecup, lady fern, maple, leaf litter, stinging nettle	26.8	Alive	
03-May-18	238	PSB	34	Alive	NA	30-May-18	6	NA	NA	Alive	Recap: Aestivation, with leaf attached to membrane

Discussion

The Three Creeks property supports a diverse group of native gastropods. As in previous years' surveys, Oregon forestsnails and Pacific sidebands were concentrated in the southern half of the Three Creeks property. In general, the southern portion is more continuous, has less impact from edge effects and fragmentation, and contains the habitat attributes typically associated with Oregon forestsnails, such as bigleaf maple and stinging nettle, as well as herb Robert, piggyback plant, and enchanter's nightshade (Heron 2018). In 2018, we doubled our survey efforts in the spring as this is the snails' breeding season and they actively cluster and seek mates. We did two spring surveys in May (May 3rd and 30th), and we detected a record number of Oregon forestsnails (n=55) mainly clustered together in the southwestern portion of Three Creeks. We also recaptured nine of the snails during our second spring survey, and they had moved 6 to 24 m in 27 days, with an average of 16(SD±5) m travelled. Interestingly, three snails that were captured together at beginning of May were all found together 27 days later 19 m southeast of the original capture location, all in aestivation. Likewise, another pair of snails that were captured together were found clustered 14 m southeast of the original capture location, also in aestivation. Group clustering during the breeding season has been previously documented for the Oregon forestsnail, although it was interesting to document them seemingly regrouping together again in clusters when in aestivation mode (OFRT 2012).

As expected, there were fewer Oregon forestsnails and Pacific sidebands detected during the 2018 and 2019 fall surveys. In total, one alive and four dead Oregon forestsnails and one alive and two dead Pacific sidebands. The alive Pacific sideband was found October 26th, 2018 in good condition underneath leaf litter but not hibernating. Interestingly, during the fall 2019 survey the one alive Oregon forestsnail documented was our first second recapture (#214). The snail was originally marked May 3rd, 2018, and then recaptured May 30th the same year and then the 2nd recapture 23 October 2019. The snail was alive and in good condition, total distanced travelled over the 1.5 years was 33 m.

Since 2014 we have marked 211 Oregon forest or Pacific sideband snails, as part of our ongoing mark-recapture study. To date, we have had 13 recaptures (11 Oregon forestsnails, 2 Pacific sidebands), of which 11 were in 2018/19. The distance travelled has ranged from 0-76 m, with an average of 22(±21) m. The oldest live recapture is an Oregon forestsnail (#68) that was captured and marked May 29th, 2015 which was then recaptured 3 years later May 30th, 2018. The snail was found 5 m from its original capture location and during this time its shell had grown by 3.2 mm. The recaptured snails are found in more open deciduous areas where bigleaf maples are dominant and there is an abundance of stinging nettle, leaf litter as well as moist porous (non-compact soil).

The snail surveys at three creeks have been ongoing since 2014, and it's interesting to note the clear delineation between the northern and the southern portion of the property in respect to Oregon forestsnail and Pacific Sideband snail detections. The northern portion has been void of both species except for six dead Oregon forestsnails detected during the first spring survey in 2014 (plot 19), and one

dead Pacific sideband in 2017 (plot 10) and 2018 (Incidental). We attribute this to two main factors, lack of suitable habitat for the species in this area such as bigleaf maples and associated leaf litter on the ground, and nettles. The soil in certain areas is very compact and disturbed due to historic land use and ongoing invasive species removal. Urban development is also a factor, residential development has occurred along all sides of the property, except the southern property line. This has led to soil disturbance, tree clearing, increased littering, and human encroachment.

As in previous years, we detected some (n=5) non-native grove snails. All were detected along the western boundary where there is single home residential development and the gardens back on to Three Creeks. Since the beginning of this study the grove snails have consistently been located along this boundary. We are encouraged by the fact that the grove snails have not been detected at plots located at the center of Three Creeks and for now at least seem to be along the perimeter of the property bordering residential gardens.

Recommendations

The BMP for Oregon forestsnails recommends conducting surveys in April - June as this is when the snails are found to be most active (Heron 2018). Our survey results correspond well with this assertion, as to date, we have found substantially more Oregon forestsnails and Pacific sidebands during the spring survey versus the fall surveys. We recommend conducting two spring (April-May) surveys in order to maximize survey efforts during the breeding season. In 2018, conducting two spring surveys increased our mark recapture results fivefold. For this year, we will conduct two surveys in May and the fall survey will be conducted in late October after significant rain but before first hard frost.

In summary, continued monitoring of this population will provide a better understanding of the life cycle of these two snail species. Learning more about the endangered Oregon forestsnail will also enable us to better protect this species in the future.

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Appendix A

Three Creeks Gastropod Survey Protocol

Purpose:

To increase our knowledge of the at-risk gastropod species occurring on this property and to monitor these snail populations

Equipment List:

- Map
- Site data card
- Mark recapture data card
- clipboard
- Pencil
- Gate key
- Waterproof notebook
- Black nail polish
- Calipers
- Flags (6)
- GPS
- Camera
- Clinometer?

Field Procedures:

1. To access the site enter from locked Gate at the end of Logan Avenue.
2. Locate plots by referring to the map. Plots will be marked with a piece of rebar with flagging tape.
3. From the plot marker measure a 5 m radius and place flags around the perimeter.

4. 20 person minutes (6 minutes and 20 seconds with three surveyors and 5 minutes with four surveyors) will be spent searching the plot for gastropods.
5. To search for gastropods, sift through leaf litter, under vegetation and on/under logs and tree trunks.
6. Place any specimens in a container for later identification to avoid interrupting the search time.
7. Once the search time is over identify, record, and mark any specimens.
 - a. Distinguish between live and dead specimens.
 - b. Measure Oregon Forestsnail and Pacific sideband using calipers.
 - c. Give a unique number identifier (*how do you know what to start at)
 - d. Mark using black nail polish.
 - e. Return live snails where they were found and leave empty shells at plot center.
8. If incidental snails or shells are found mark and measure them and record a GPS location. Record I for incidental in the “plot #” column.

Filling out the Data Form:

1. A site card is filled in for each plot
2. The top portion of the card describes the site details
 - a. Location will be Three Creeks
 - b. Aspect is the direction the slope is facing
 - c. Slope is the angle of the slope
 - d. For overstory record dominant tree cover
 - e. For moss cover record a general statement (e.g. low, medium, high)
 - f. For CWD record number of pieces
3. The middle portion of the card describes the micro habitat
 - a. Inundated means flooded
 - b. Dry-mesic means there is a moderate or well-balanced amount of moisture
4. The bottom portion of the card describes the species found
5. A separate data card (the mark recapture card) is used to record snail measurements. Be sure to make note of any recaptures.
 - a. Aestivation means a state of dormancy. You can identify a state of aestivation by....
6. *a list should be added here of drop-down options from filemaker once they are decided to make for consistent data*

Species of Interest at Three Creeks

Oregon Forestsnail



- Deep central whorl on the underside of shell
- Thickened shell lip

Pacific sideband



- Deep central whorl on the underside of shell
- Usually seep pink, dark orange or burgundy
- Distinct band on side of shell

Northwest Hesperian



- Deep central whorl on the underside of shell
 - tiny hairs all over shell
-

Lancetooth



- deep central whorl on the underside of shell

Grovesnail



- lacks deep pit on the underside of the shell
- shell patterns vary
- typical garden snail

Chocolate Arion



- hole on side of slug
- wrinkled surface

Banana slug



- hole on the side of slug
- usually have a yellowish body but can be green, brown, or white
- large (up to 25 cm)

SITE DETAILS	Date		Surveyor(s)		Overstory			
	Plot #		Plot size		Moss Cover			
	UTM		Location		CWD			
	Start Time		Aspect		Soil comments			
	End Time		Slope					
MICROHABITAT	Light:	<input type="checkbox"/> Open <input type="checkbox"/> Filtered <input type="checkbox"/> Partial <input type="checkbox"/> Shade		Moisture:	<input type="checkbox"/> Inundated <input type="checkbox"/> Dry-mesic <input type="checkbox"/> Saturated (wet-mesic) <input type="checkbox"/> Dry (xeric) <input type="checkbox"/> Moist (mesic)			
	Slope Position:	<input type="checkbox"/> Crest <input type="checkbox"/> Lower Slope <input type="checkbox"/> Upper slope <input type="checkbox"/> Toe of Slope <input type="checkbox"/> Mid slope <input type="checkbox"/>		Disturbance:	<input type="checkbox"/> Erosion <input type="checkbox"/> Natural <input type="checkbox"/> Soil compacted <input type="checkbox"/> Grazed <input type="checkbox"/> Contaminants present <input type="checkbox"/> Disturbed			
	Other:	<input type="checkbox"/>						
SPECIES	Species	# Alive	# Dead	Condition	Species	# Alive	# Dead	Condition
	Oregon Forestsnail				Grovesnail			
	Pacific sideband				Chocolate Arion			
	Northwest Hesperian				Banana slug			
	Lancetooth							

