Purple Loosestrife Biocontrol Agent Monitoring Project 2006

Earth Design Consultants, Inc.
www.earthdesign.com

Site: Tenasillahe Island
Dates: June 16 & July 29, 2006

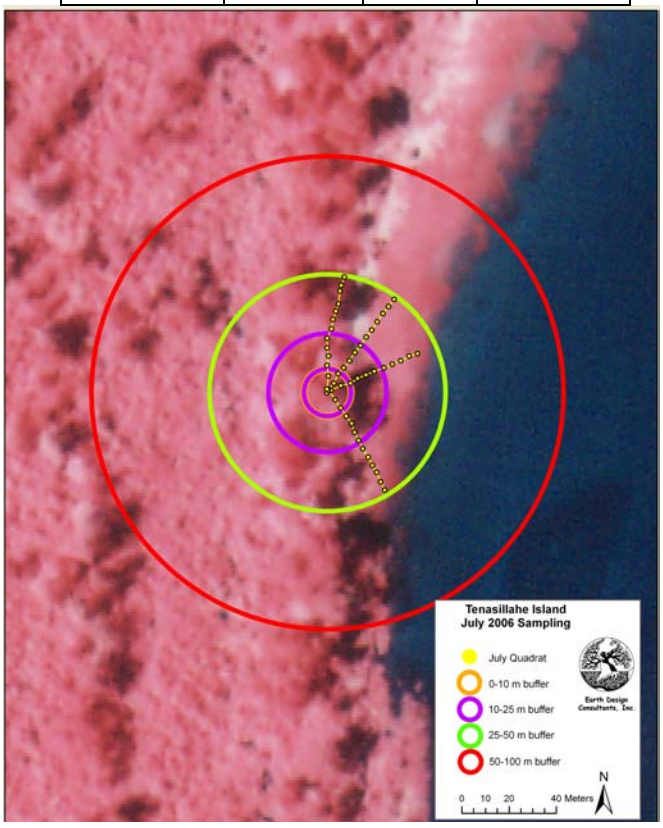
Lat/Long: 46.215062576 N, 123.437970297 W NAD83 Conus

Columbia River Mile: ~ 39

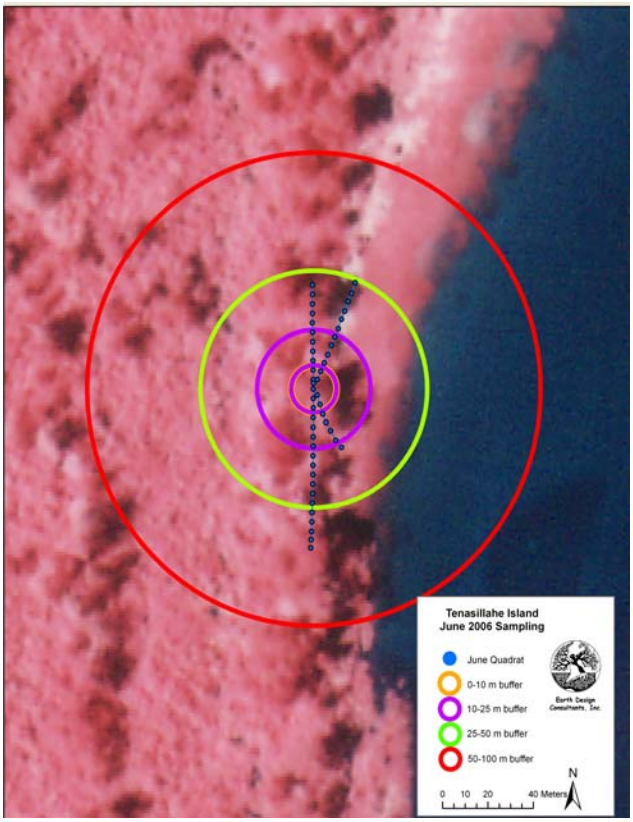
Mean +/- S.D., Range in Elevation: 2.2 m +/- 0.2, 1.7-2.7 m NAVD88

Distance to High Ground: 7.78 m
Distance to Shrub/Forest Cover:

	CASI[1]	CIR[1]	ETM+[1]
Shrub	NA	0.0	21.1m
Forest	NA	0.0	186.0m



July quadrat locations.



June quadrat locations.

Field sampling was conducted during two separate periods during 2006, June and July. During each sampling period, 50 $1m^2$ quadrats were sampled along variable length transects radiating from a biocontrol agent release point.

The quadrat locations from each sampling period are displayed on color infrared photos of the site. The rings or buffers around each site indicate different distances (10, 25, 50, and 100 m) from the initial biocontrol release point. These buffers are used to summarize various field measures as a function of

[1] CASI=compact airborne spectrographic imager; CIR=color infrared photos; ETM+=enhanced thematic mapper plus; see main report for details

distance from the initial biocontrol release point.

Observations of the presence and number of biocontrol agents including *Galerucella pusilla* (GAPU), *G. calmariensis* (GACA), *Hylobius transversovittatus* (HYTR), and *Nanophyes marmoratus* (NAMA), were made. We also observed the percent damage caused by the biocontrol agents, the number of new and old purple loosestrife (*Lythrum salicaria*), and noted other plant damage.

We created a digital elevation model (DEM) for each site using points collected using RTK (real time kinematic) GPS. Elevation was measured to within 2cm accuracy at approximately 200 points around the initial biocontrol release point during the RTK data collection and a grid was then created from this data. We used this DEM to assign elevation values to each quadrat. These elevations will be used to examine tidal inundation and relationships between biocontrol agent success and elevation.

Site Summaries for each month

In the following tables, variables measured during the field sampling are summarized by sampling period (June or July). Shown are the average, minimum, and maximum values for measures of biocontrol agent presence and damage, along with the number of new and old purple loosestrife stems averaged over the total number of quadrats sampled in either the June or July period.

	Galerucella pusilla Adult	*Galerucella calmariensis* Adult	*Galerucella nymphaeae* Adult	*Galerucella* Egg	*Galerucella* Larvae	% *Galerucella* Damage	% *Hylobius transversovittatus* Damage	*Nanophyes marmoratus* Adult	Other Herbivore Damage	New Stem Number	New Stem Length (cm)	Old Stem Number
June												
mean	0	0	0	0	1	1				6	62	2
st dev	0	0	0	0	2	2				8	63	4
min	0	0	0	0	0	0				0	0	0
max	0	0	0	0	11	12				36	197	19
proport	0	0/50	0/50	0/50	5/50	23/50	0/50	0/50	3/50	28/50		15/50
%	0	0	0	0	10	46	0	0	6	56		25
July												
mean	0	0	0	0	0	1				4	155	1
st dev	0	0	0	1	0	2				6	61	3
min	0	0	0	0	0	0				0	31	0
max	1	0	2	3	0	10				30	260	13
proport	1/50	0/50	2/50	8/50	0/50	16/50	0/50	0/50	17/50	18/50		6/50
%	2	0	4	16	0	32	0	0	34	36		12

Relationship between elevation, biocontrol agents, and *L. salicaria*

Correlations between quadrat elevation, biocontrol agent measures, and the number of purple loosestrife stems are presented in the tables below. Only those quadrats for which an elevation value was available from RTK data are included in these correlations. Variables for which the Pearson correlation value is "(a)" indicate no correlation because one of the variables was constant. Significant correlations are indicated with a single asterisk (*) at 0.05 level (2 tailed significance) and a double asterisk (**) at the 0.01 level (2 tailed). Scatter plots of statistically significant correlations are also displayed.

		# GAPU adult	# GACA adult	# GA adult	# GA egg mass	# GA larvae	% GA damage	# NAMA adults	% HYTR damage	# new stems	# old stems
June	Correlation	(a)	(a)	(a)	(a)	0.13	0.106	(a)	(a)	0.019	0.214
	Sig. (2-tailed)					0.372	0.47			0.895	0.141
	N	49	49	49	49	49	49	49	49	49	49
July	Correlation	0.112	(a)	0.231	.359(*)	(a)	.434(**)	(a)	.475(**)	(a)	0.332*
	Sig. (2-tailed)	0.445		0.111	0.011		0.002		0.001		0.02
	N	49	49	49	49	49	49	49	49	49	49

new *L. salicaria* stems from June and July (98 quadrats) correlated with elevation is significant at the p=0.01 level – Pearson's correlation r=0.3, p=0.003.

Correlations between these field variables and quadrat elevation were significant at the 0.05 level at this site:

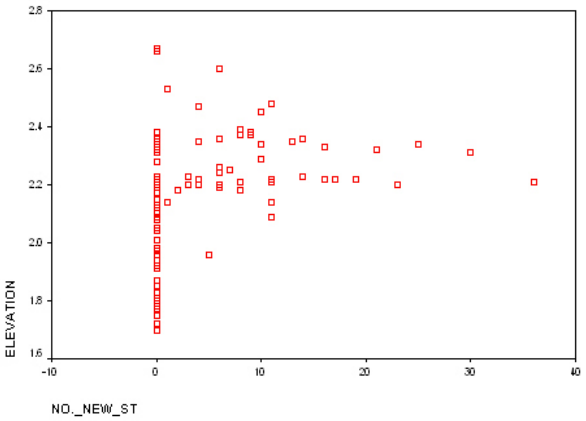
July: # GA eggs and elevation
July: # old L. salicaria *stems and elevation*

Correlations between these field variables and quadrat elevation were significant at the 0.01 level at this site:

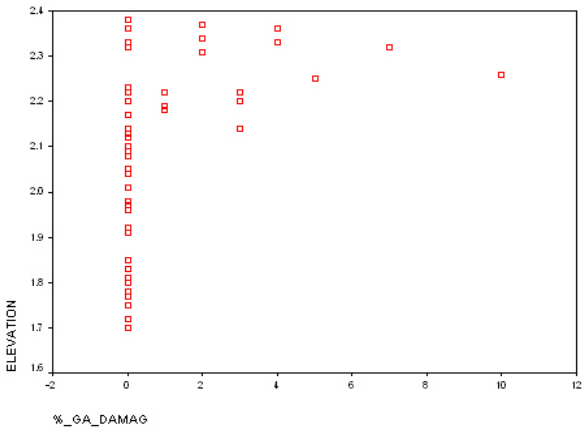
June and July together: # new L. salicaria *and elevation*
July: % GA damage and elevation
July: # new L. salicaria *and elevation*

June & July:

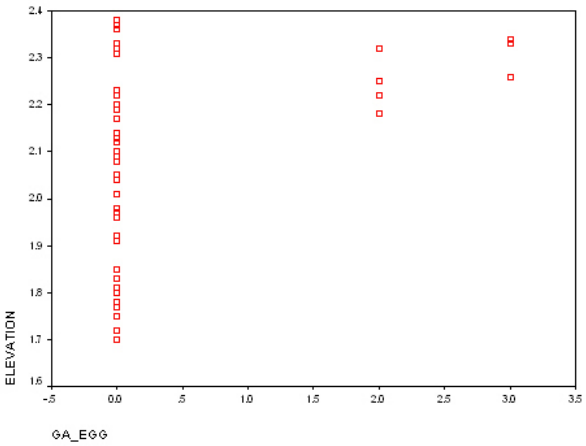
New PLS Stems & Elevation



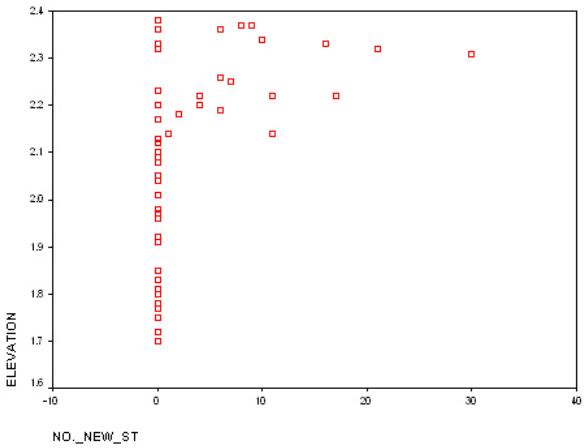
July: % GA Damage & Elevation



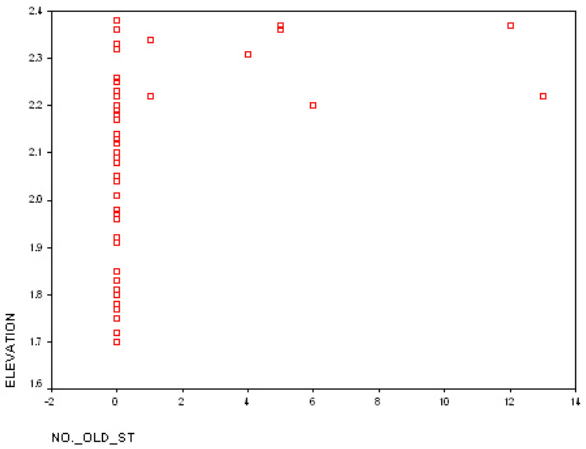
July: # GA Egg Masses & Elevation



July: # New PLS Stems & Elevation



July: # Old Stems & Elevation



Buffered Distance Summaries:

In the following tables, variables measured during the field sampling are summarized for June and July by distance from the initial biocontrol release point. Shown are the average, minimum, and maximum values for measures of biocontrol agent presence and damage, along with the number of new and old purple loosestrife stems averaged over the total number of quadrats within each distance buffer (i.e. ring or donut) sampled in either the June or July period.

	June	*Galerucella pusilla* Adult	*Galerucella calmariensis* Adult	*Galerucella nymphaeae* Adult	*Galerucella* Egg	*Galerucella* Larvae	% *Galerucella* Damage	% *Hylobius transversovittatus* Damage	*Nanophyes marmoratus* Adult	Other Herbivore Damage	New Stem Number	New Stem Length (cm)	Old Stem Number
10 m	mean	0	0	0	0	0	1	0	0		11	105	1
	st dev	0	0	0	0	2	2	0	0		11	47	2
	min	0	0	0	0	0	0	0	0		0	6	0
	max	0	0	0	0	5	5	0	0		36	171	5
	proport	0/11	0/11	0/11	0/11	1/11	7/11	0/11	0/11	0/11	8/11		5/11
	%	0	0	0	0	9	64	0	0	0	73		45
25 m	mean	0	0	0	0	1	2				6	115	4
	st dev	0	0	0	0	1	3				6	28	6
	min	0	0	0	0	0	0				0	15	0
	max	0	0	0	0	5	12				23	148	19
	proport	0/16	0/16	0/16	0/16	3/16	8/16	0/16	0/16	3/16	11/16		8/16
	%	0	0	0	0	19	50	0	0	19	69		50
50 m	mean	0	0	0	0	1	1				4	104	1
	st dev	0	0	0	0	3	1				7	34	1
	min	0	0	0	0	0	0				0	33	0
	max	0	0	0	0	11	3				25	162	5
	proport	0/18	0/18	0/18	0/18	1/18	6/18	0/18	0/18	0/18	6/18		2/18
	%	0	0	0	0	6	33	0	0	0	33		11
100 m	mean	0	0	0	0	0	1				4	115	
	st dev	0	0	0	0	0	2				5	29	
	min	0	0	0	0	0	0				0	75	
	max	0	0	0	0	0	5				11	160	
	proport	0/5	0/5	0/5	0/5	0/5	2/5	0/5	0/5	0/5	3/5		0/5
	%	0	0	0	0	0	40	0	0	0	60		0

	July	*Galerucella pusilla* Adult	*Galerucella calmariensis* Adult	*Galerucella nymphaeae* Adult	*Galerucella* Egg	*Galerucella* Larvae	% *Galerucella* Damage	% *Hylobius transversovittatus* Damage	*Nanophyes marmoratus* Adult	Other Herbivore Damage	New Stem Number	New Stem Length (cm)	Old Stem Number
10 m	mean	0	0	0	1	0	2				6	156	1
	st dev	0	0	0	1	0	3				5	64	4
	min	0	0	0	0	0	0				0	31	0
	max	1	0	0	3	0	10				17	260	13
	proport	1/10	0/10	0/10	5/10	0/10	7/10	0/10	0/10	7/10	8/10		2/10
	%	10	0	0	50	0	70	0	0	70	80		20
25 m	mean	0	0	0	0	0	1				2	176	2
	st dev	0	0	0	1	0	1				4	44	3
	min	0	0	0	0	0	0				0	53	0
	max	0	0	1	3	0	4				10	243	12
	proport	0/16	0/16	1/16	1/16	0/16	5/16	0/16	0/16	6/16	6/16		5/16
	%	0	0	6	6	0	31	0	0	38	38		31
50 m	mean	0	0	0	0	0	1				3	128	0
	st dev	0	0	0	1	0	2				8	65	1
	min	0	0	0	0	0	0				0	53	0
	max	0	0	2	3	0	7				30	250	4
	proport	0/24	0/24	1/24	2/24	0/24	4/24	0/24	0/24	4/24	4/24		1/24
	%	0	0	4	8	0	17	0	0	17	17		4

No quadrats fell in the 100 m buffer area during the July 2006 sampling.

Tide Summary

NAVD88, meters		**June**	**July**
>3.2	>Highest Tide	0	0
2.77 to 3.1	MHHW to Highest Tide	0	0
1.55 to 2.76	MSL to MHHW	100	100
0.22 to 1.54	MLLW to MSL	0	0
-0.33 to 0.21	Lowest to MLLW	0	0
<-0.34	<Lowest Tide	0	0

The table above presents the percentage of quadrats sampled during June or July that have elevations that are either above the highest tide water level, between MHHW and the highest tide, between MSL and MHHW, between MLLW and MSL, between MSL and the lowest tide water level, and below the water level of the lowest tide. All quadrats are between MSL and MHHW, roughly 1.5 m NAVD88.

Knappa Slough	Tide Level (zero is MLLW)	Cumulative Percentage of Time	Elevation (NAVD88)
>MHHW	>8.3 ft	3.2%	>9.0 ft
>MSL	>4.3 ft	48.3%	>5.1 ft
>MLLW	>0 ft	94%	>0.7 ft
<MLLW	<0 ft	94.7-100%	<0.7 ft

The table above reports the percentage of time water levels at the tide gauge nearest the study site were above MHHW, above MSL, above MLLW, and below MLLW. Calculations are based on tidal values from every hour of every day between June 1, 2005 – December 31, 2006 at the nearest tidal gauge station of Knappa Slough; calculating the number of number of hours where the hourly tide level was in a given category (i.e. >MSL, >MLLW, etc.).[2] The elevations presented in the column marked "NAVD88" are equivalent to the tide levels in the second column but are simply converted from the MLLW to the NAVD88 tidal datum. This table indicates that only 3% of the time water levels are above the MHHW mark (8.3 ft MLLW) at this site. Forty-eight percent of the time water levels exceed MSL (4.3 ft), 94% of the time water levels exceed MLLW, and 95-100% of the time areas below MLLW (0 ft elevation) are under water.

Site Photos


View to south. June, 2006.


View to northeast. July, 2006.

[2] Nobeltec Tides and Currents software was used to generate tidal values and allows for the prediction of future tide levels. No adjustment was made for the distance of the biocontrol release point from the tidal gauge station because the effect due to distance is unknown and likely insignificant at the scale of the release points from one another.