

BC Ministry of Forests, Lands and Natural Resource Operations
Forest Analysis and Inventory Branch (FAIB)

Monitoring Harvest Activity Across 28 Mountain Pine Beetle Impacted Management Units

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Introduction

The information on the total harvest, pine harvest and particularly dead pine harvest is crucial in assessing the government's large-scale salvage policy that harvest should be focused on beetle-infested pine stands. Therefore, this report will update the previous report "Monitoring Harvest Activity Across 28 Mountain Pine Beetle Impacted Management Units" dated on May 27, 2013, by including dead harvest and updating pine volumes in the stands on the Timber Harvesting Land Base (THLB). This report uses the TSAs and TFLs included in the previous report (Figure 1) and summarizes harvest activity from January 1, 2010 to December 31, 2014.

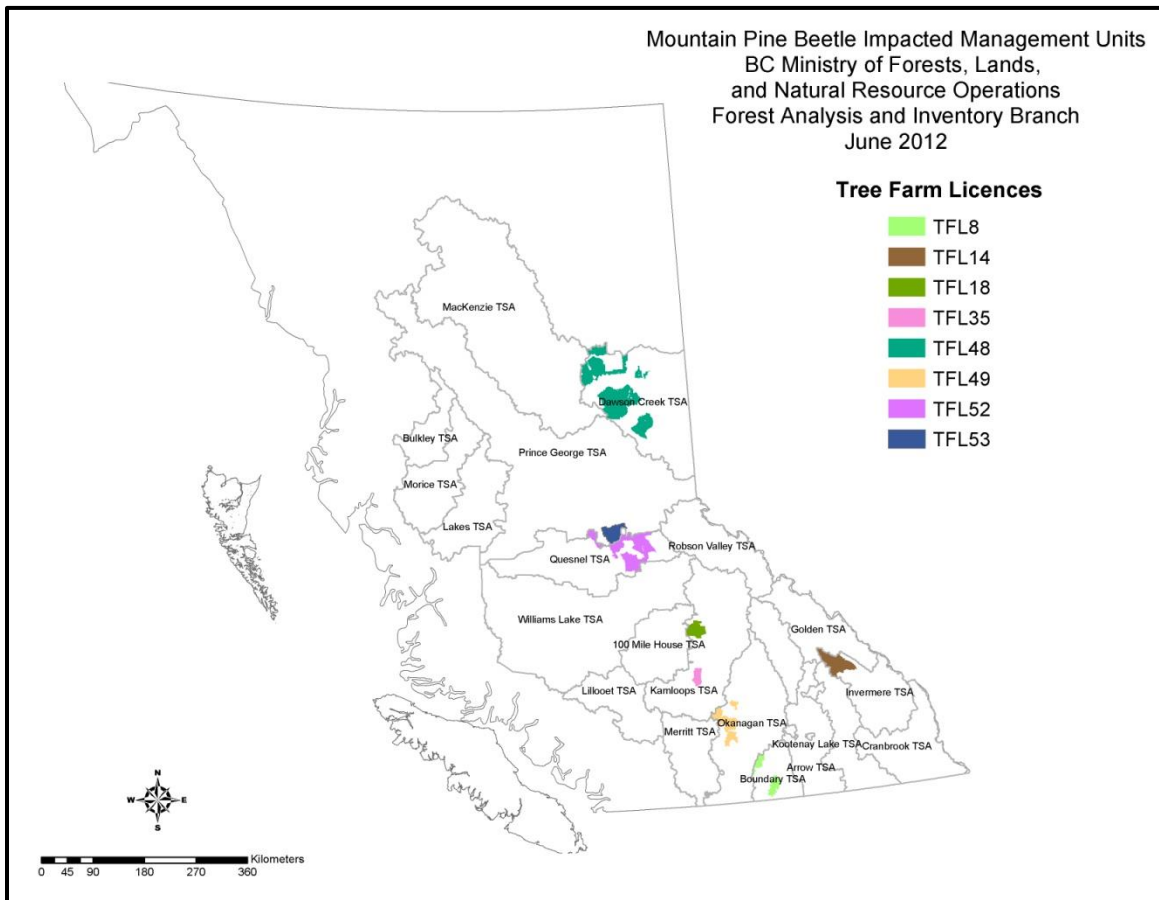


Figure 1 Management units (TSAs and TFLs) monitored for harvest activity.

Method

The statistics used in this report include: (1) total harvest; (2) total non-pine harvest; (3) total pine harvest; (4) total live harvest; (5) total dead harvest; (6) total live pine harvest; and (7) total dead pine harvest.

Data from the Harvest Billing System (HBS) and the Electronic Commerce and Appraisal System (ECAS) maintained by the Timber Pricing Branch, Ministry of Forests, Lands and Natural Resource Operations (FLNR) were analysed to produce this report. The HBS data have been updated to December 31, 2014. The ECAS data were derived from the Interior Stone Query updated to February 11, 2015. The ECAS data contain all fully appraised timber marks that had been harvested since 2003. ECAS started collecting the mountain pine beetle infestation data in 2010. Therefore, this report only summarizes dead harvest from 2010, providing a baseline for the later reporting. To be consistent, total harvest statistics were also summarized from 2010 to 2014. The statistics only include the volumes from the timber marks with the land type of “Crown”. The pine in this report refers to lodgepole pine.

The HBS data were used to summarize total harvest, total non-pine harvest, and total pine harvest. Live and dead harvest statistics were derived from both the HBS and ECAS data. Since the HBS data (both scale-based and cruised-based live harvest) does not distinguish between live and dead volume, the following approaches were used to estimate dead pine harvest: (1) for each timber mark of the HBS data, the percentage of dead pine volume of total pine volume was estimated from the ECAS data and applied to the total pine volume of each HBS timber mark; (2) for the HBS timber marks that matched with those of the ECAS timber marks, the percentages of dead pine volume were directly estimated from the matched ECAS timber marks; (3) for those unmatched timber marks of HBS but associated with spatial features, a spatial approach was used to estimate the percentage of dead pine volume from spatial ECAS timber marks, that is, take an average of percentages of dead pine volume from the 10 ECAS timber marks nearest to each spatial HBS timber mark; (4) for those unmatched HBS timber marks but also not associated with spatial features, an average percentage of dead pine volume estimated from the ECAS data for each TSA or TFL was applied to each of those unmatched and non-spatial HBS timber marks; (5) for the cruise-based live HBS timber marks, the approaches described above in (2) and (4) were applied. To estimate the total live pine harvest, the dead pine volumes from both scale-based and cruised-based (i.e., dead pine volumes coded with 8 and dead pine volumes from those live harvest timber mark coded with 7) harvest were removed from the total pine volume. However, the total live harvest did not exclude the dead harvest from the species other than pine because no dead harvest data are available for those non-pine species except for the harvest from the cruise-based timber marks coded with “8”.

This report also updates the information of total pine and dead pine volumes in the management units. For TSAs, the percentages of pine volume and the volume of pine (live and dead) remaining in the management units were generated through the combination of 2014 vegetation resource inventory, logging history and the timber harvesting land base spatial datasets. For TFLs, the Ministry of Forests, Lands and Natural Resource Operations did not have a recent and consistent vegetation resource inventory and timber harvesting land base. Instead, an older compilation of vegetation resource inventory and timber harvesting land base (circa the year

2001) were used. The percentage of pine volume and the volume of pine remaining in the management units were generated through the combination of the older vegetation resource inventory (no differentiation was made between live and dead pine volumes) and the timber harvesting land base with the current inventory of logging history. Percent of dead pine volume for the TFLs was estimated from the BC Mountain Pine Beetle Spread Model (www.for.gov.bc.ca/hre/bcmapb). The management units (TSAs and TFLs) in this report are in descending order based on the percentage of pine volume in the stands on the THLB.

Results

Overall, the total pine harvest slightly increased in 2011 and then decreased throughout 2012-2014. The percentages of pine in the total harvest remained above 50% but consistently decreased from 2010 to 2014 while the percentages of dead pine in the total pine harvest increased from 2010 to 2012 and then remain at a stable level of about 74% (Figure 2).

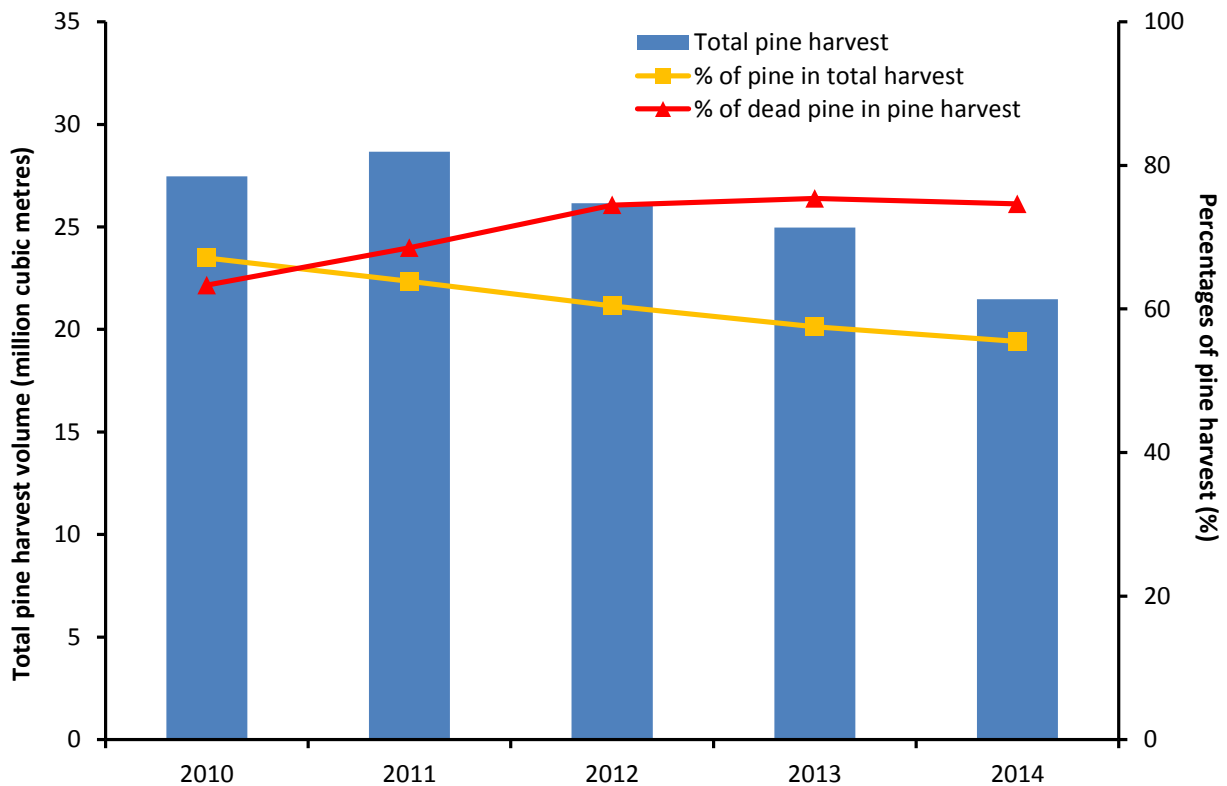


Figure 2. Total pine harvest and percentages of pine harvest for the all monitoring management units.

The statistics of harvest for each management unit (TSA or TFL) are summarized in Figures 3-30 along with an indication of the allowable annual cut (AAC) and harvest partitions in place over that monitoring period. Percentages of pine in total harvest and dead pine in the pine harvest are summarized in Tables 1 and 2.

For the total pine harvest, most of the TSAs showed decreasing trends (Lakes, Quesnel, Cranbrook, Williams Lake, Merritt, Prince George, Morice, 100 Mile House, Kootenay Lake, Okanagan, Golden, Arrow, Kamloops, and Robson Valley). Similarly, decreasing trends were also observed in the total pine harvest for most of the TFLs (Figures 23-30).

There were 15 management units where pine comprised less than 50% of the total harvest for the last two years (2013 and 2014) (Lillooet, Dawson Creek, Kamloops, Robson Valley, Invermere, Okanagan, Kootenay Lake, Golden, Arrow, TFLs 08, 49, 52, 35, 18, and 53). Of these, six of them (Invermere, Lillooet, Golden, and Arrow TSAs, and TFLs 52 and 53) had lower percentages of pine in the total harvest compared to the actual percentages of the pine volume in the management units, consistently or in the last two recent years (Table 1), which implies that the policy of increasing the pine harvest from beetle-infested pine stands was not achieved from these units. Similarly, 11 of the management units had less than 50% of dead pine in the total pine harvest throughout the monitoring period (2010-2014) (Cranbrook, Robson Valley, Invermere, Boundary, Okanagan, Bulkley, Kootenay Lake, Golden, Arrow, and TFLs 8, 14, and 53) and four of them had lower percentages of dead pine in the total pine harvest than actual percentages of the dead pine volume in the management units consistently or in the last two recent years (Table 2).

Harvest relative to the AACs and partitions varies by management unit from 2010 to 2014 with harvests both above and below the AAC. One reason for under- or overharvest of the AAC may be related to licensee cut control periods (the period over which harvest must not exceed the AAC) not coinciding with the monitoring period.

Conclusion

Although a declining trend has been observed in both total pine harvest and percentage of pine in the total harvest, overall percentages of pine in the total harvest are well above 50%, and percentages of dead pine in the total pine harvest increased and stabilized well above 60% in the recent years (2012-2014) (Figure 2). Furthermore, most of the management units were much higher in both percentages of pine in the total harvest and dead pine in the total pine harvest compared to actual percentages of total pine and dead pine volumes in the management units (Tables 1 and 2). Therefore, the harvest activity on most of the management units would generally meet the government policy that increases total pine and dead pine harvest from beetle-infested stands. Where AACs appear to be overharvested on average for the monitoring period 2010 to 2014, follow-up is required to determine if this is an artifact of cut control or if it is an issue that requires further exploration.

Acknowledgements

Stephen G. Davis and Steve Fletcher provided the HBS and ECAS data. Credits are given to S. Fletcher and Marvin Eng for the help in understanding the HBS and ECAS systems and in developing the technical approaches used in this report. We also thank Atmo Prasad and Albert Nussbaum for insightful guidance and comments, particularly for the editorial work by A. Prasad.

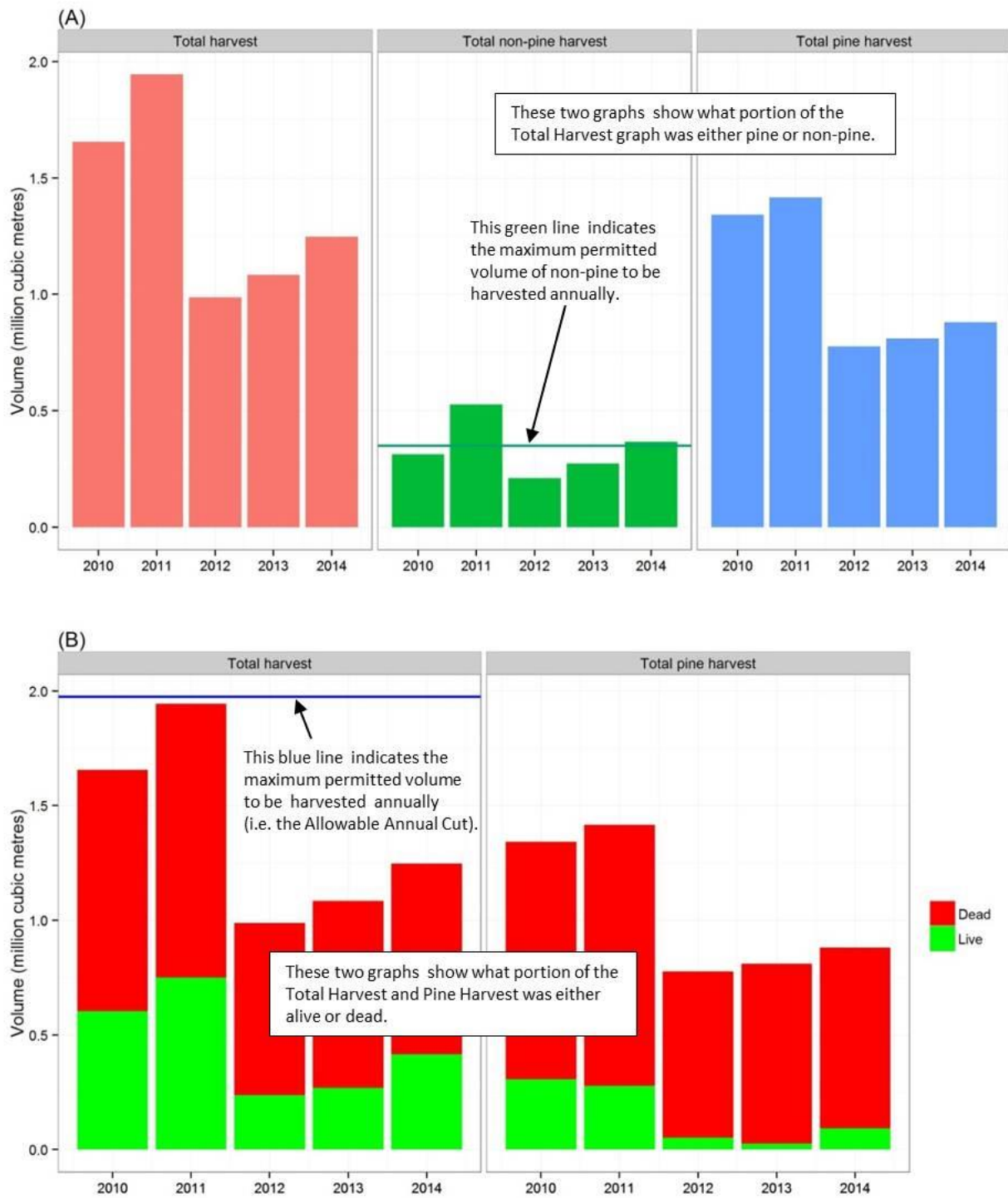


Figure 3. Harvest summary for the Lakes TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The green line in (A) indicates the non-pine partition level while the blue line in (B) represents the AAC level.

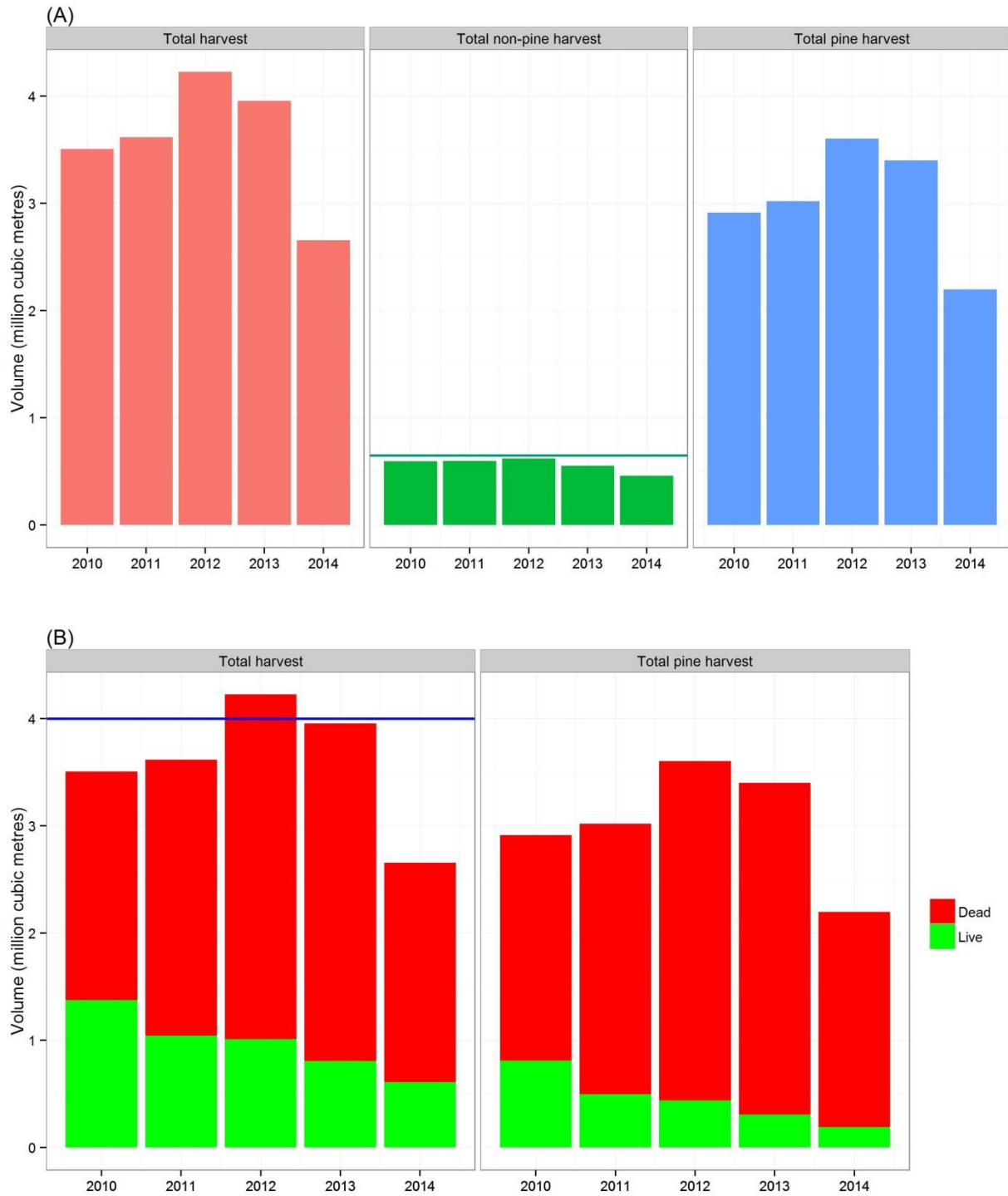


Figure 4. Harvest summary for the Quesnel TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The green line in (A) indicates the non-pine partition level while the blue line in (B) represents the AAC level.

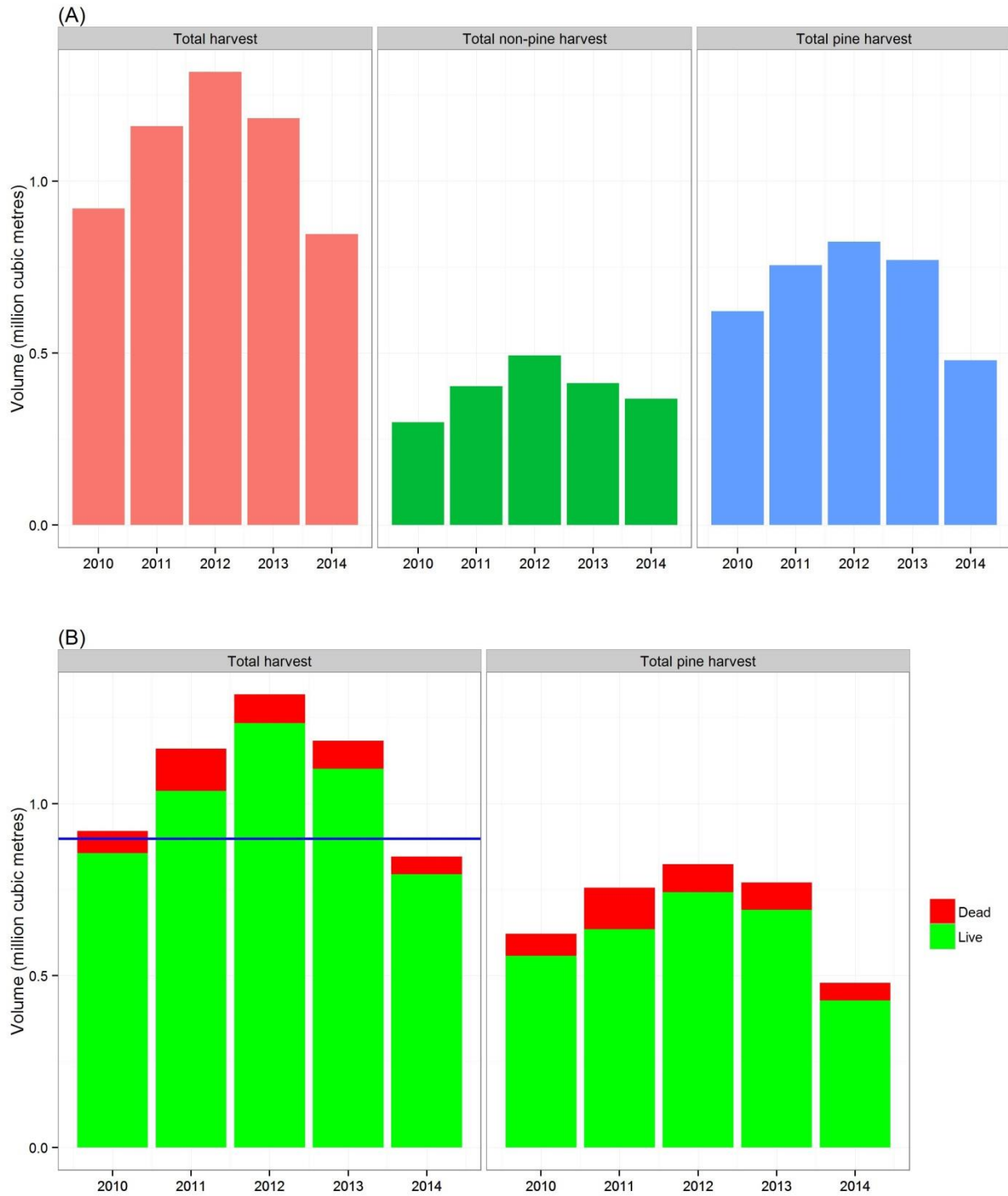


Figure 5. Harvest summary for the Cranbrook TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

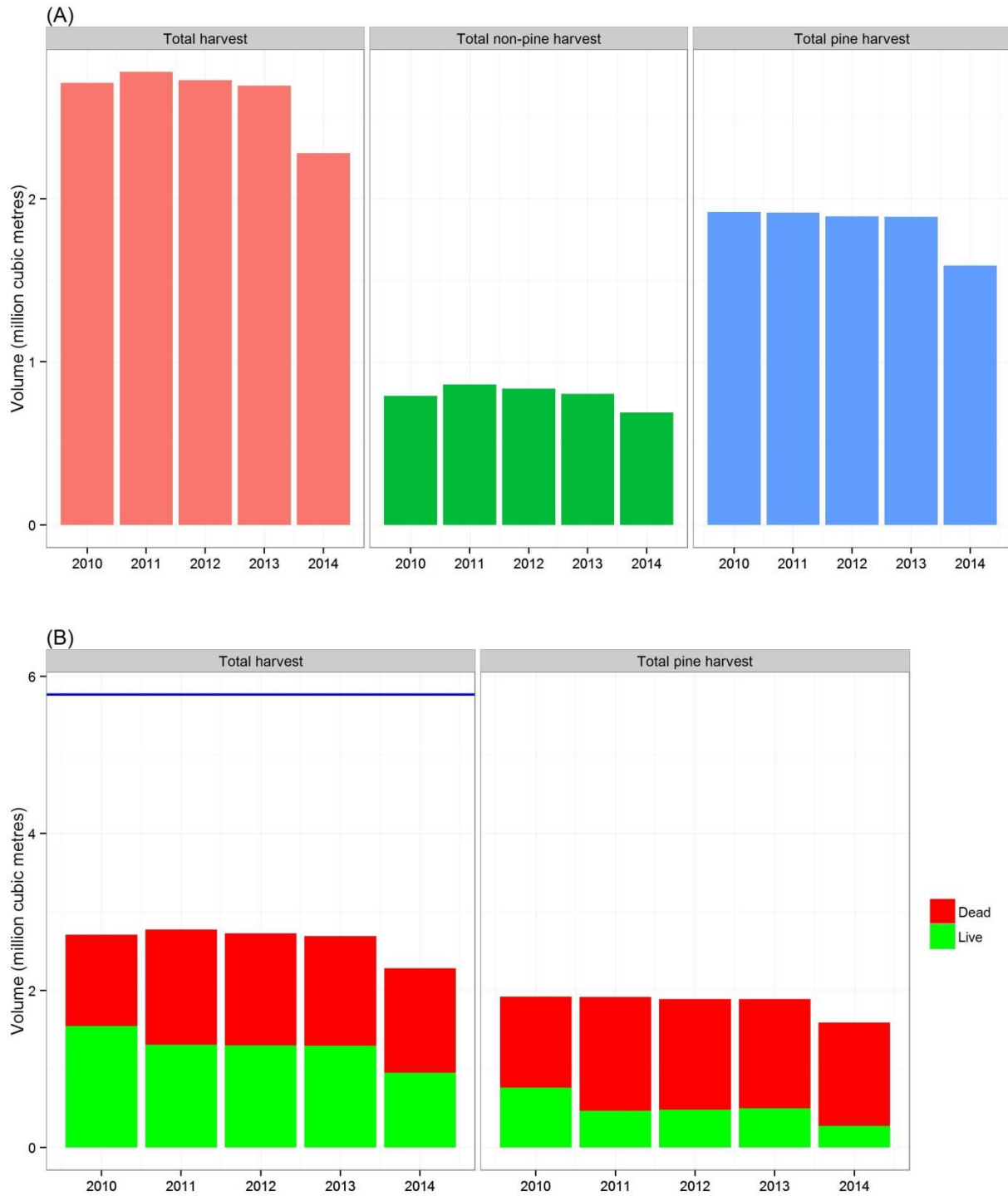


Figure 6. Harvest summary for the Williams Lake TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

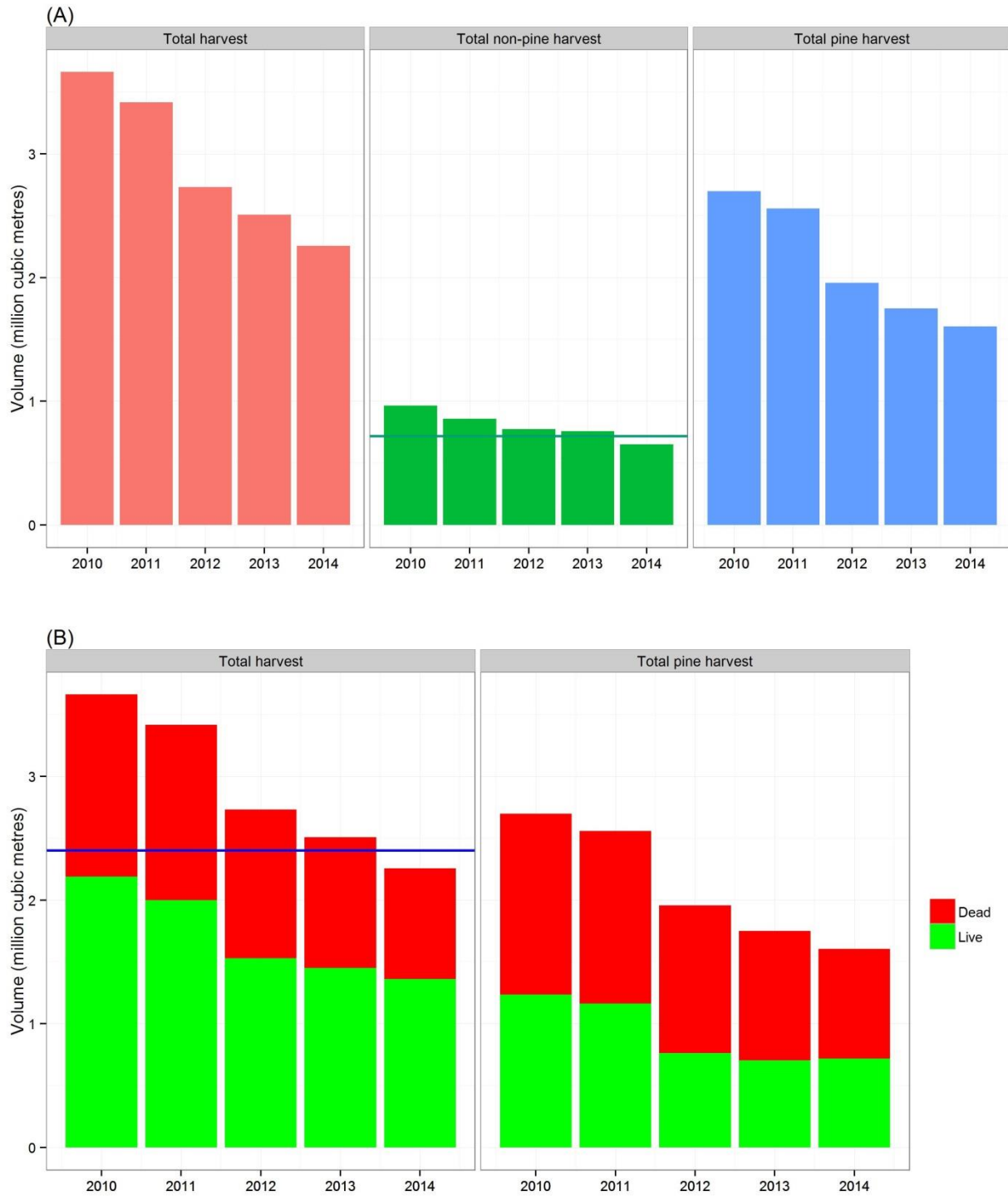


Figure 7. Harvest summary for the Merritt TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The green line in (A) indicates the non-pine partition level while the blue line in (B) represents the AAC level.

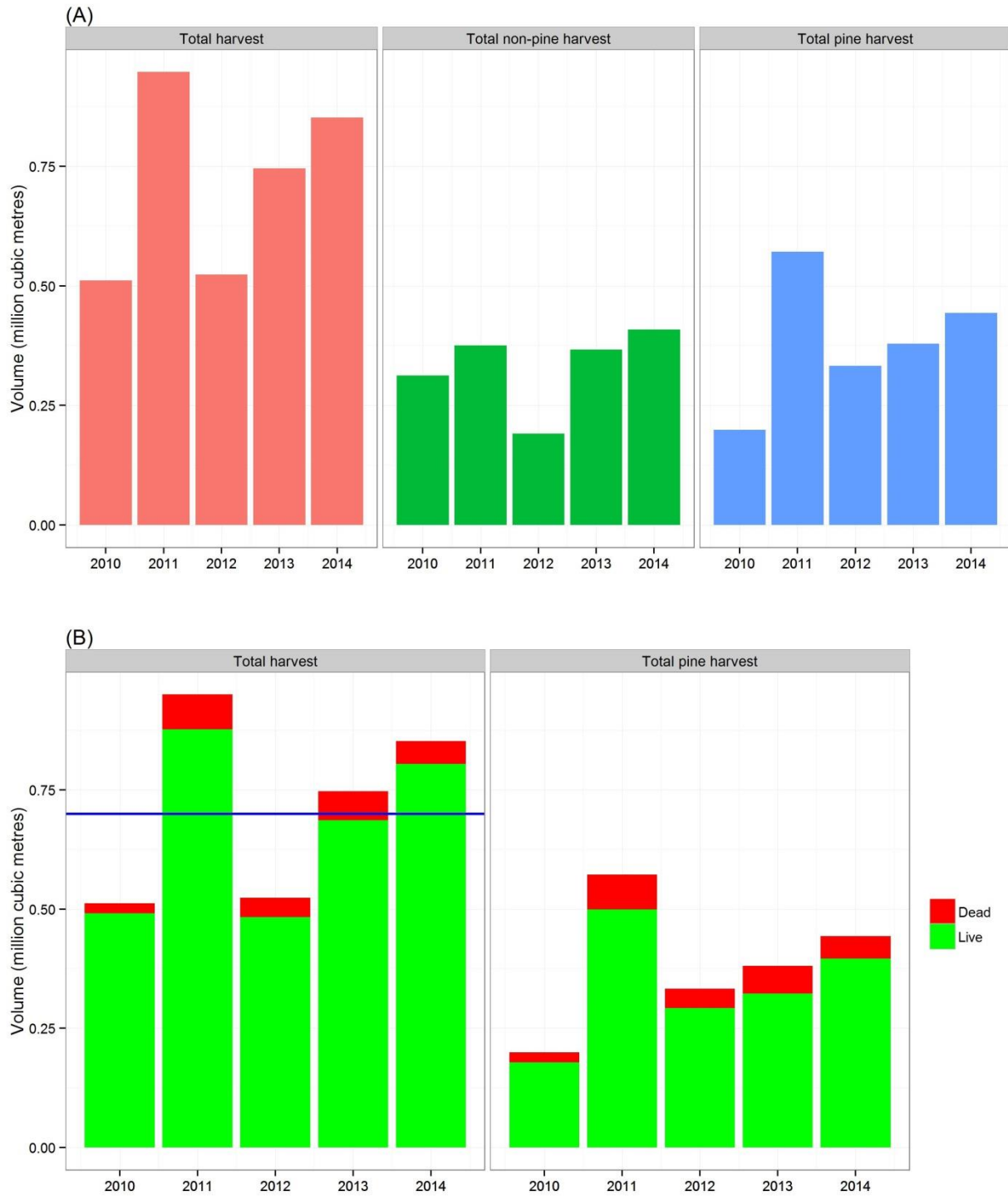


Figure 8. Harvest summary for the Boundary TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

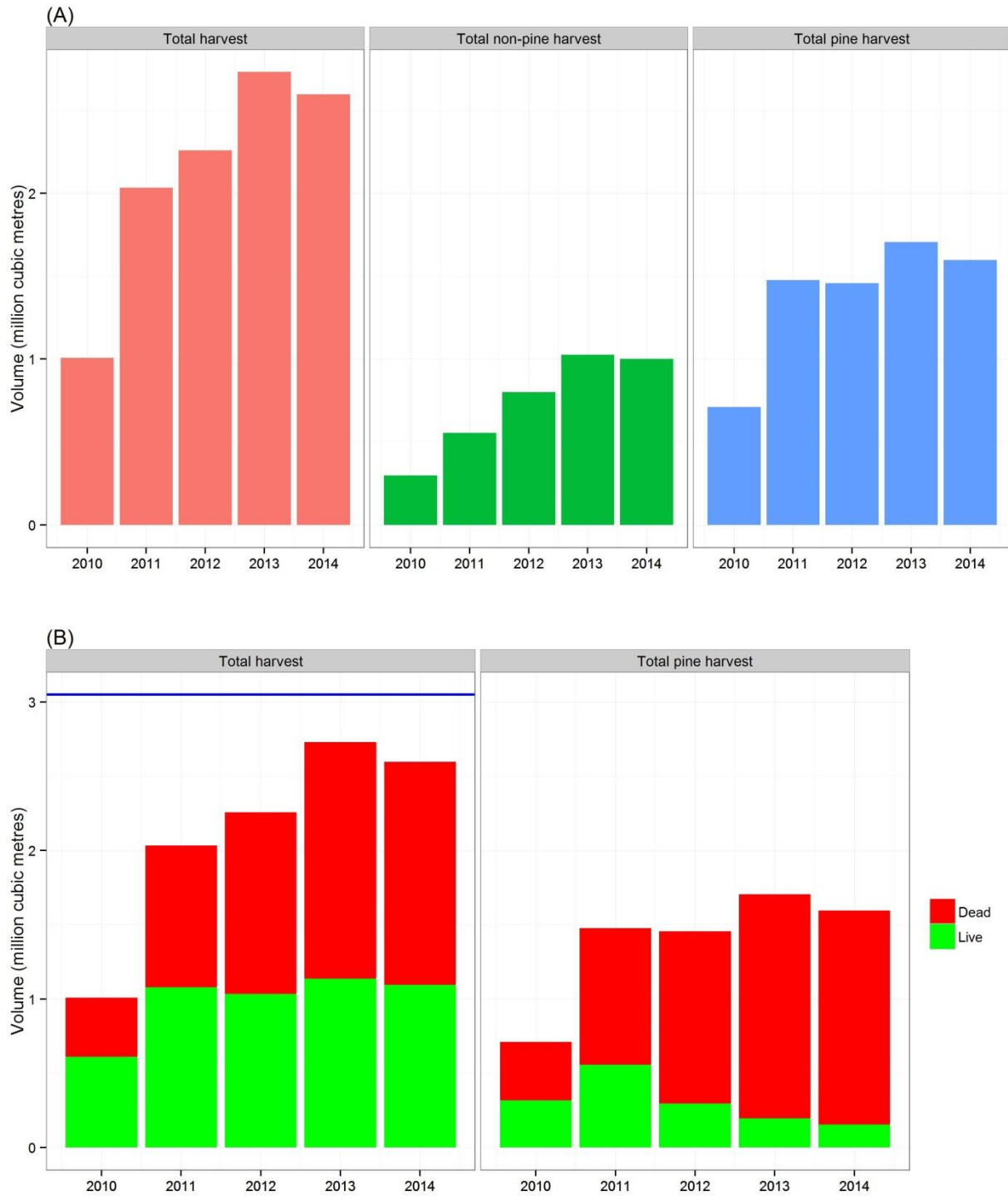


Figure 9. Harvest summary for the Mackenzie TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

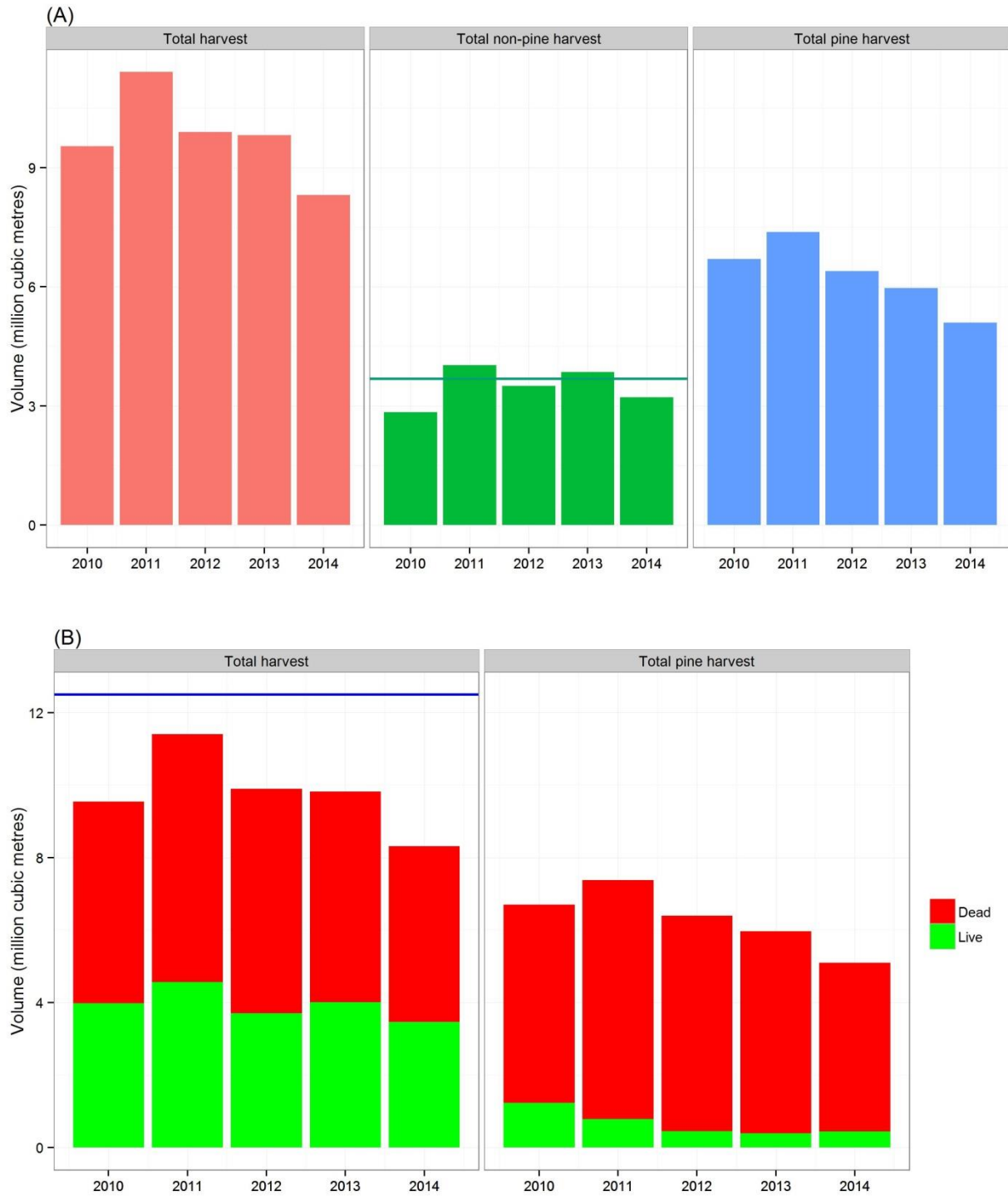


Figure 10. Harvest summary for the Prince George TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The green line in (A) indicates the non-pine partition level while the blue line in (B) represents the AAC level.

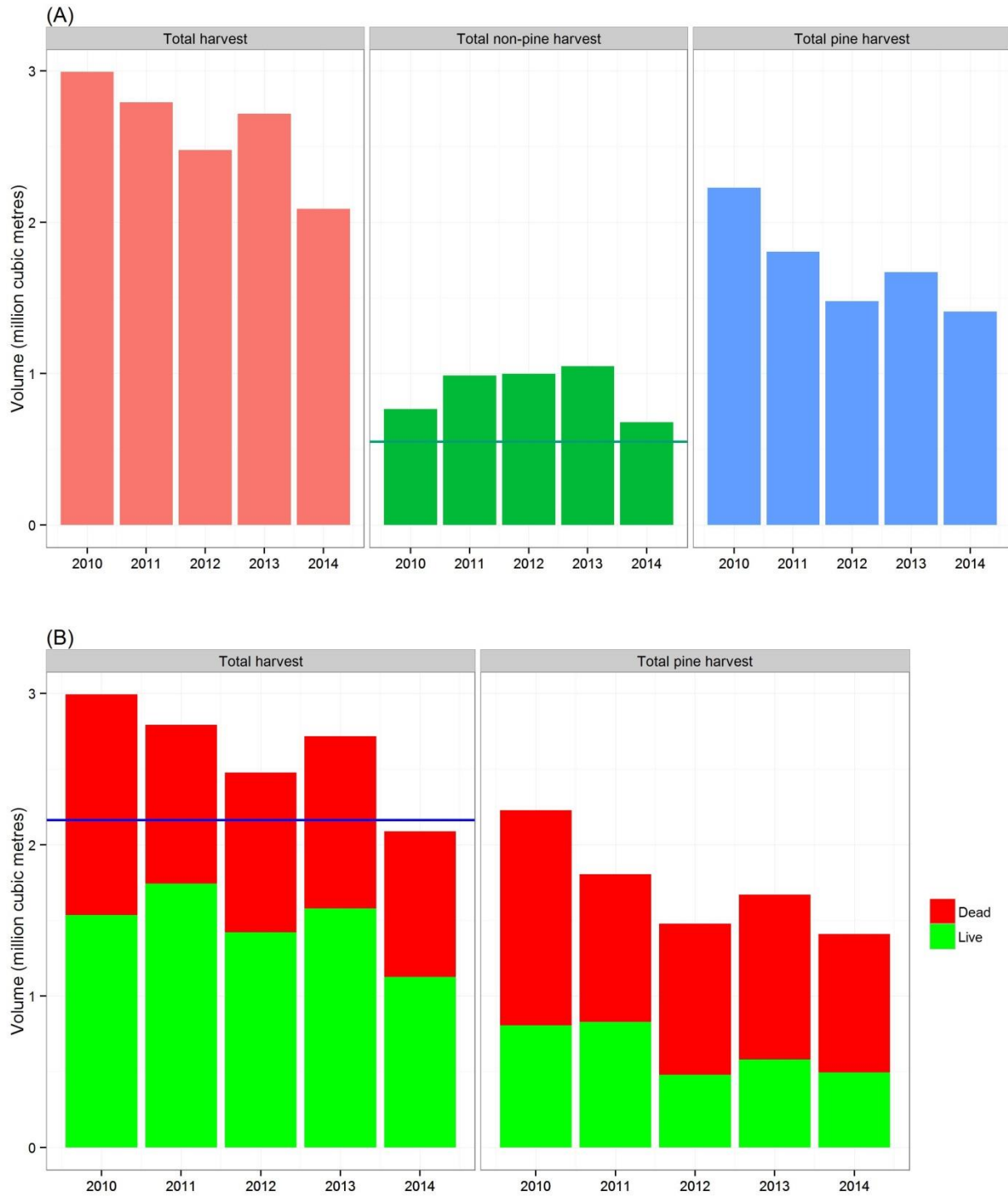


Figure 11. Harvest summary for the Morice TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The green line in (A) indicates the non-pine partition level while the blue line in (B) represents the AAC level.

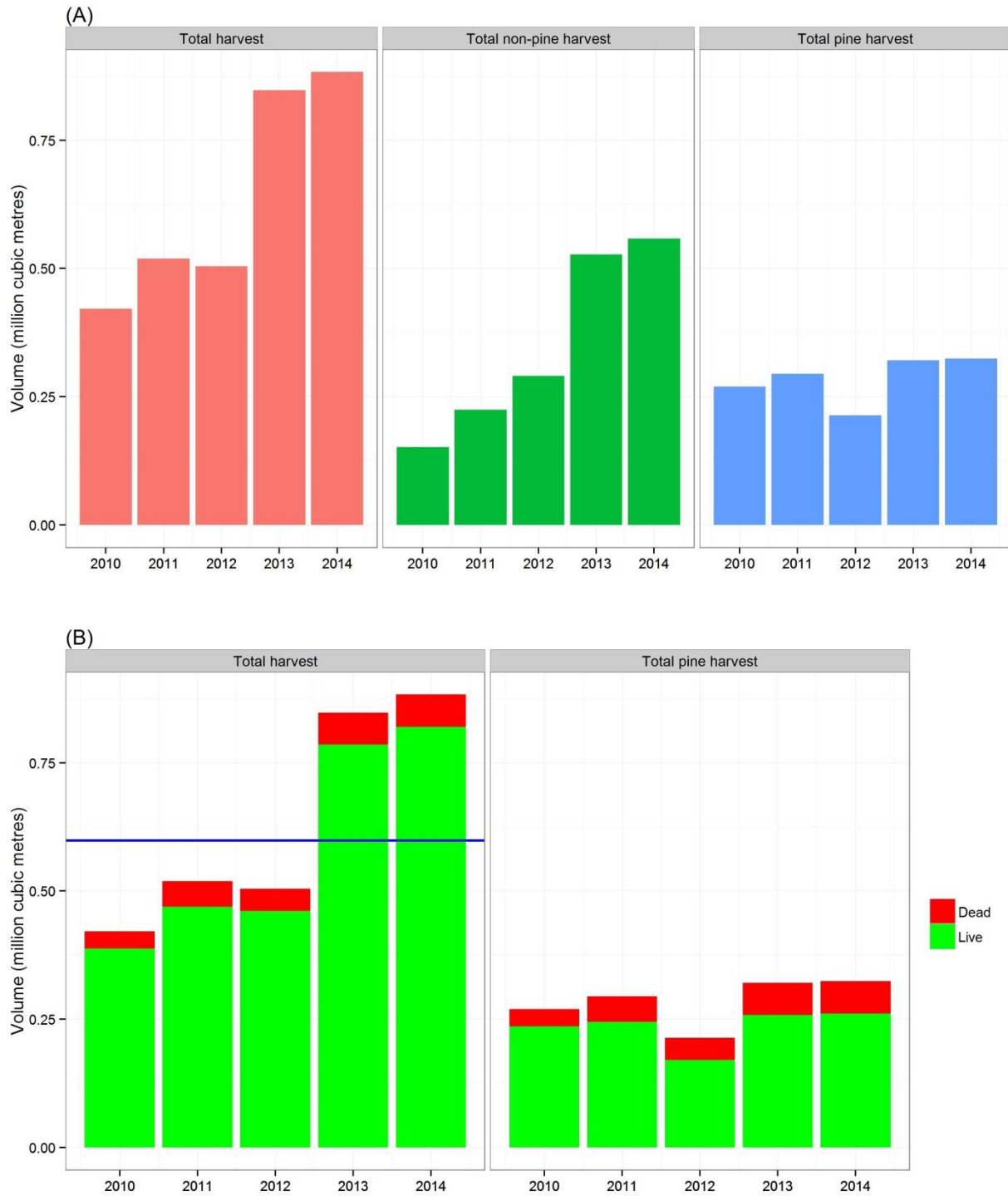


Figure 12. Harvest summary for the Invermere TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

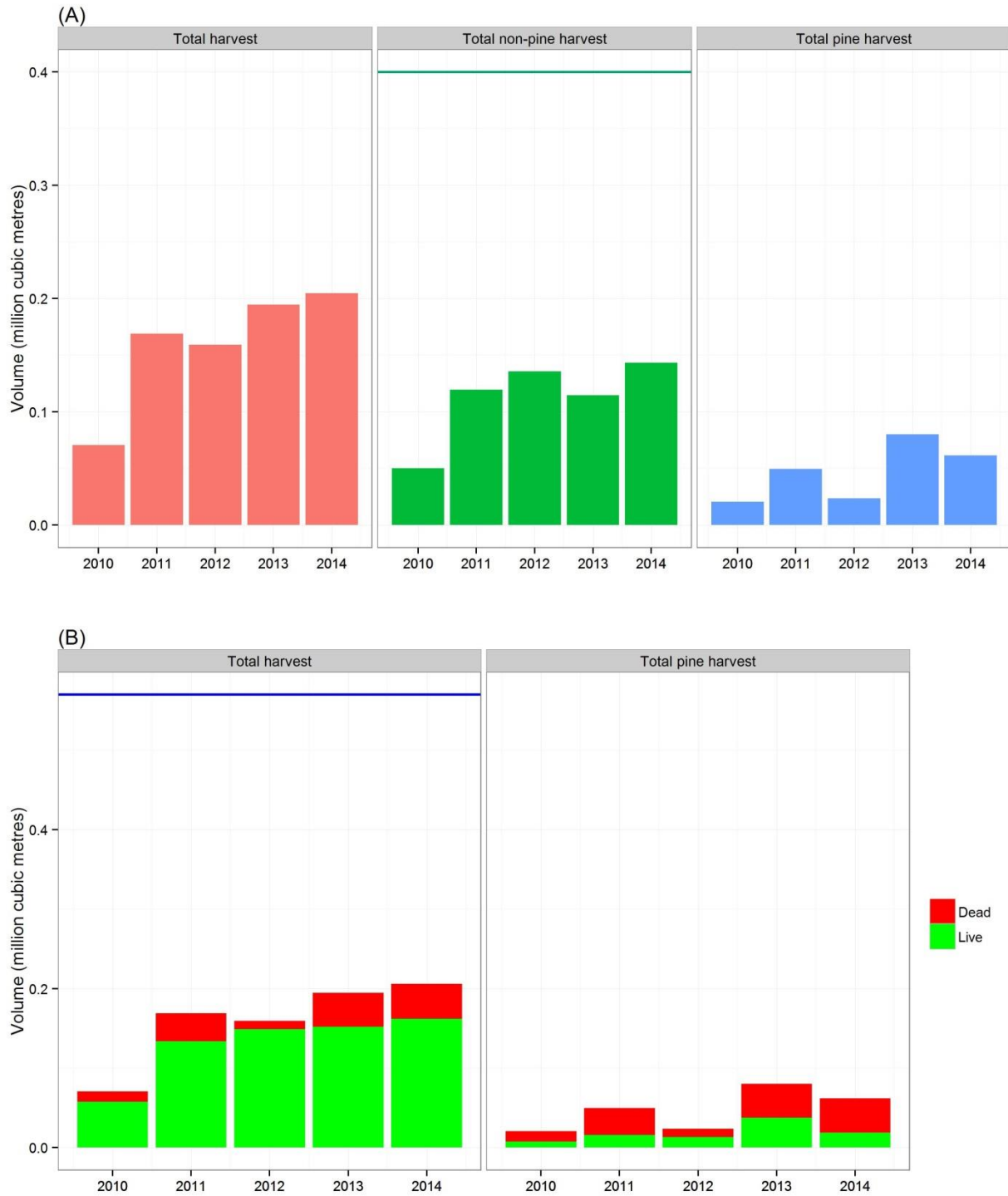


Figure 13. Harvest summary for the Lillooet TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

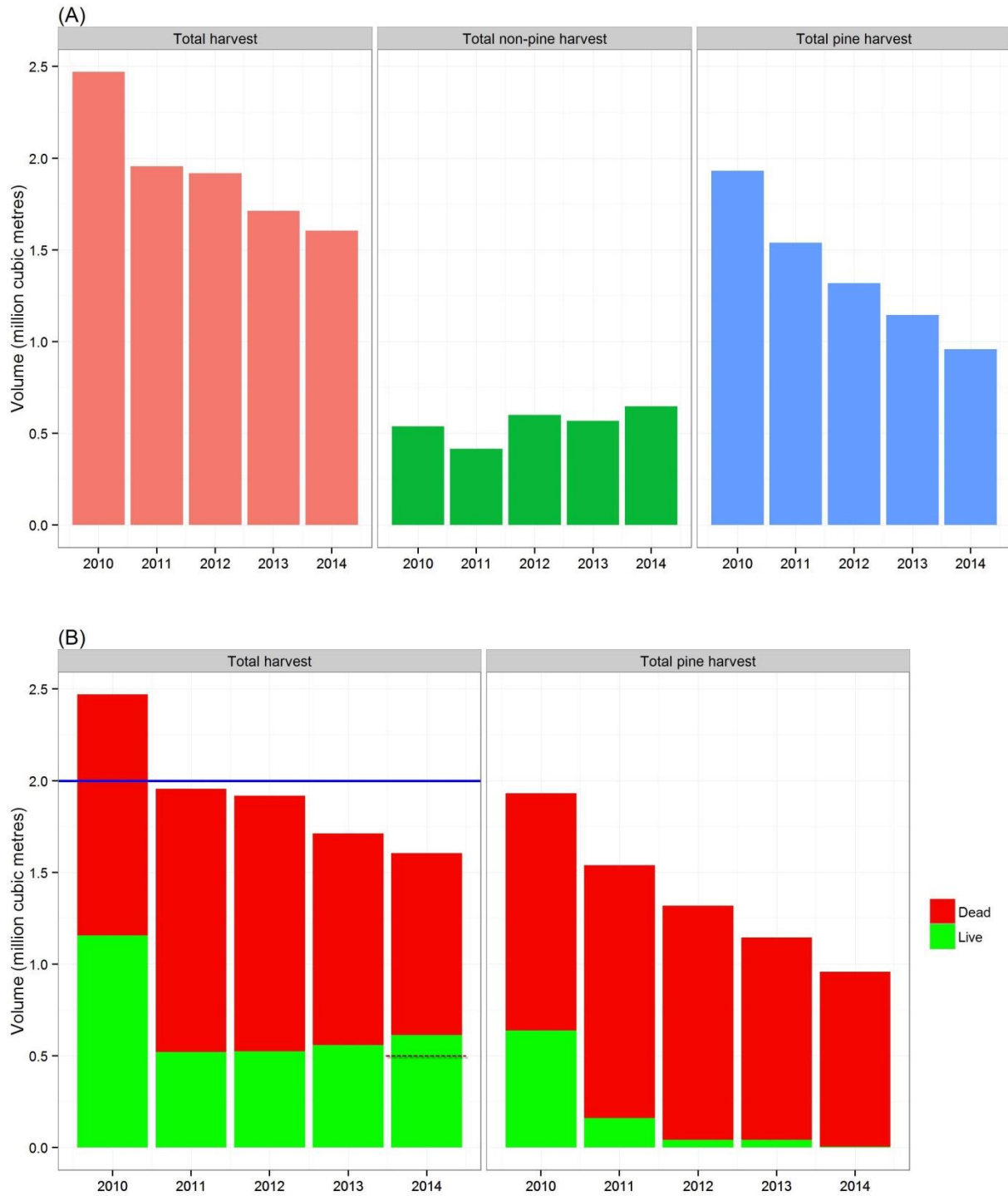


Figure 14. Harvest summary for the 100 Mile House TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) indicates the AAC level while the dashed line represents the live volume partition level.

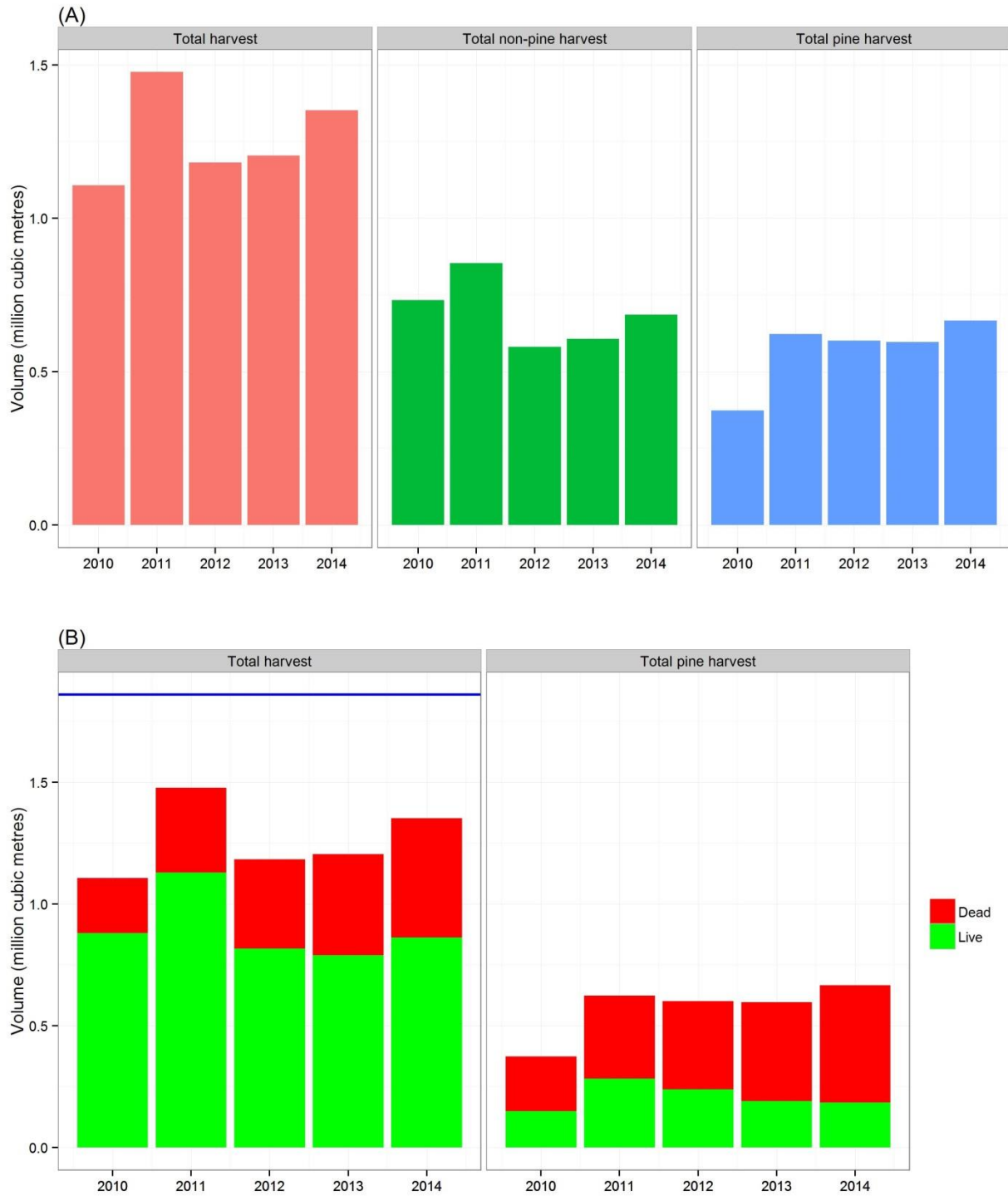


Figure 15. Harvest summary for the Dawson Creek TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

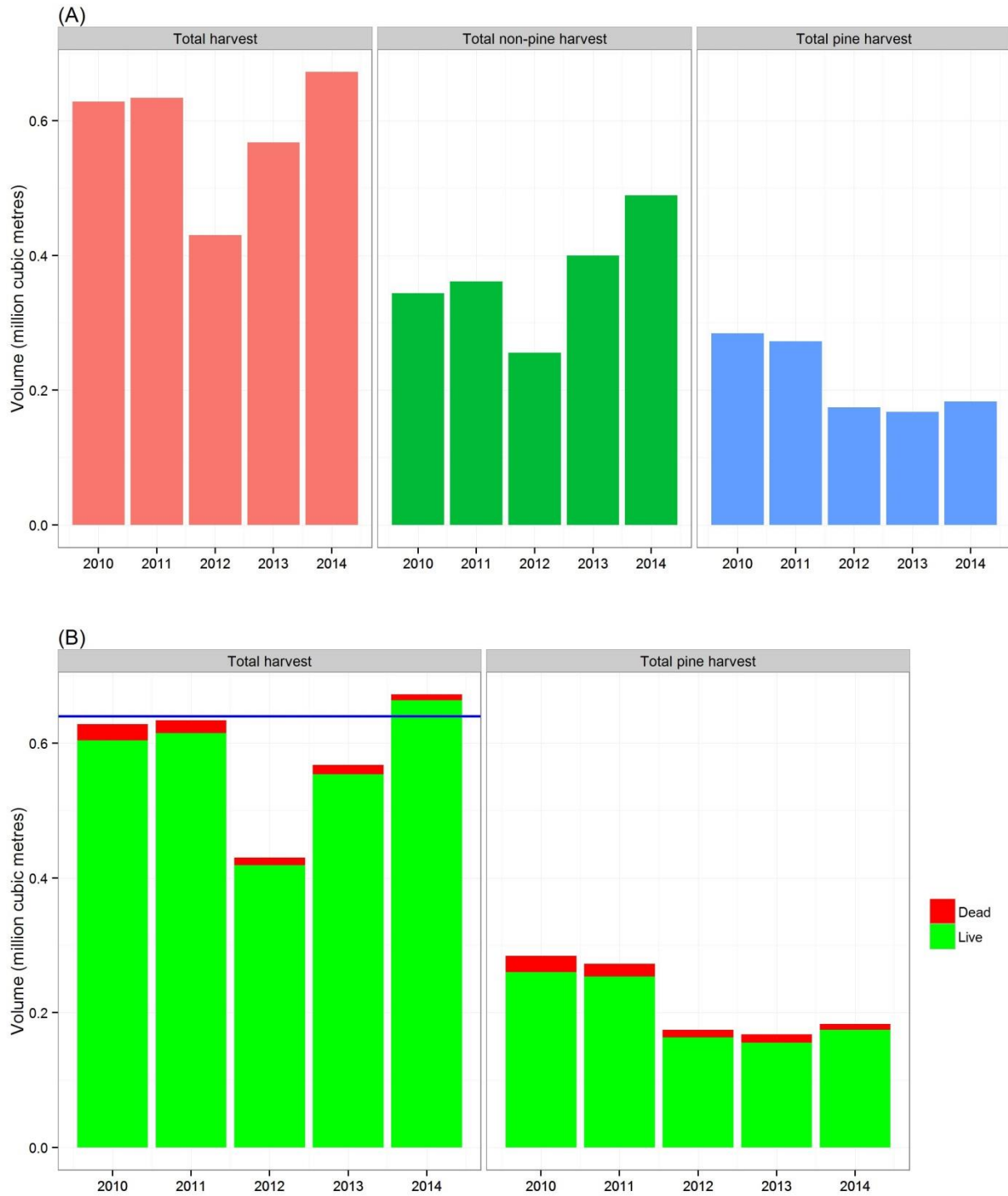


Figure 16. Harvest summary for the Kootenay Lake TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

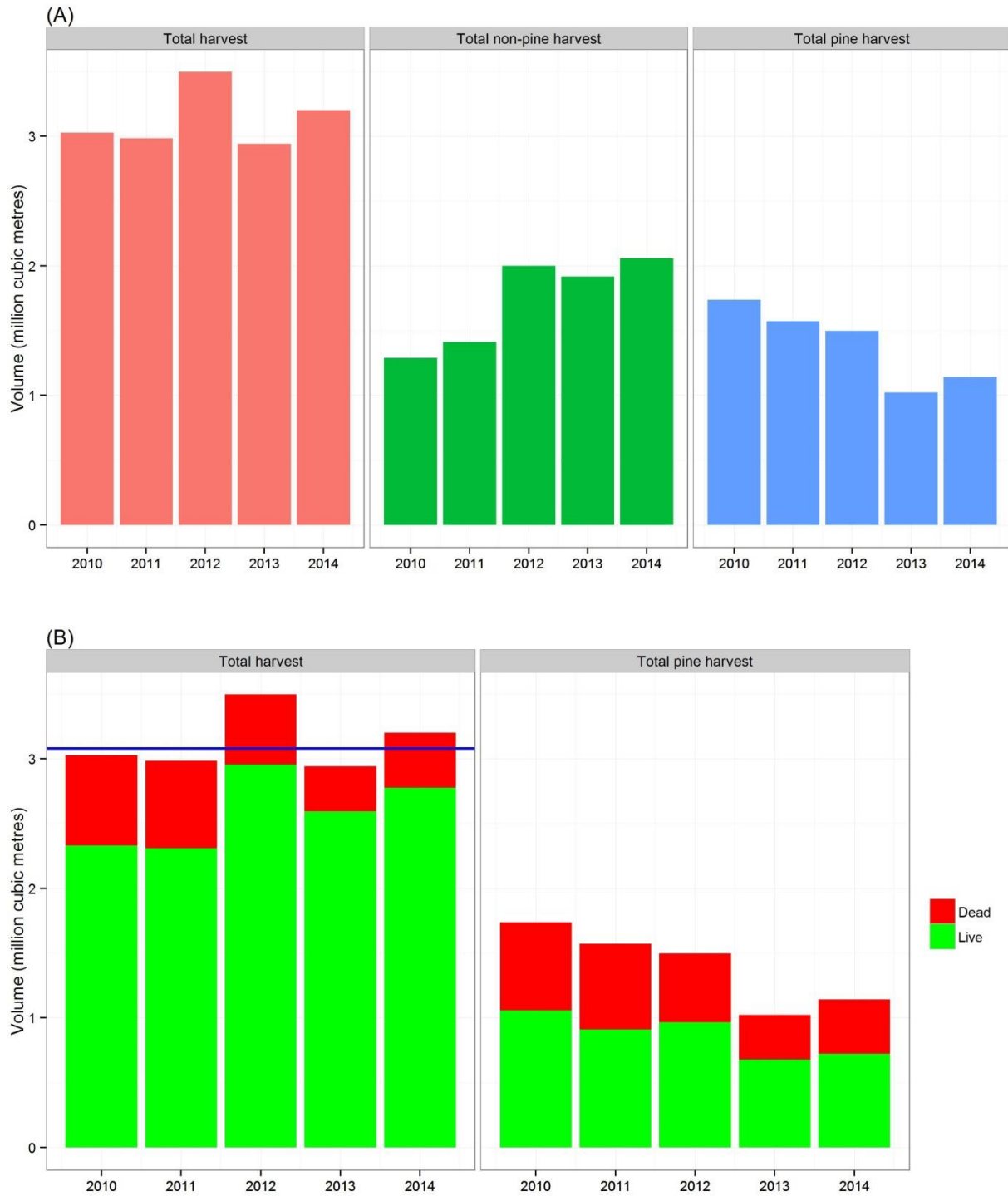


Figure 17. Harvest summary for the Okanagan TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

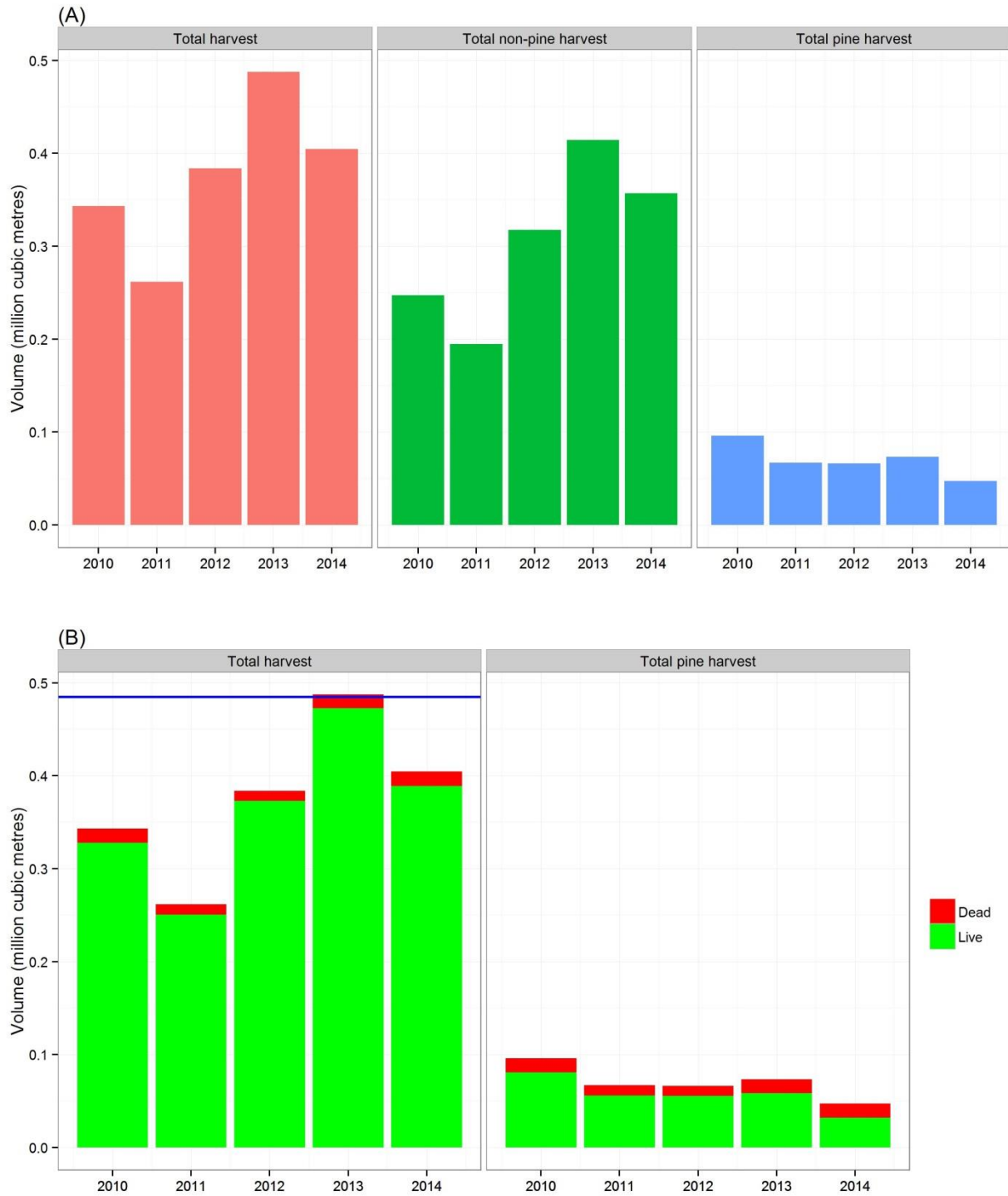


Figure 18. Harvest summary for the Golden TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

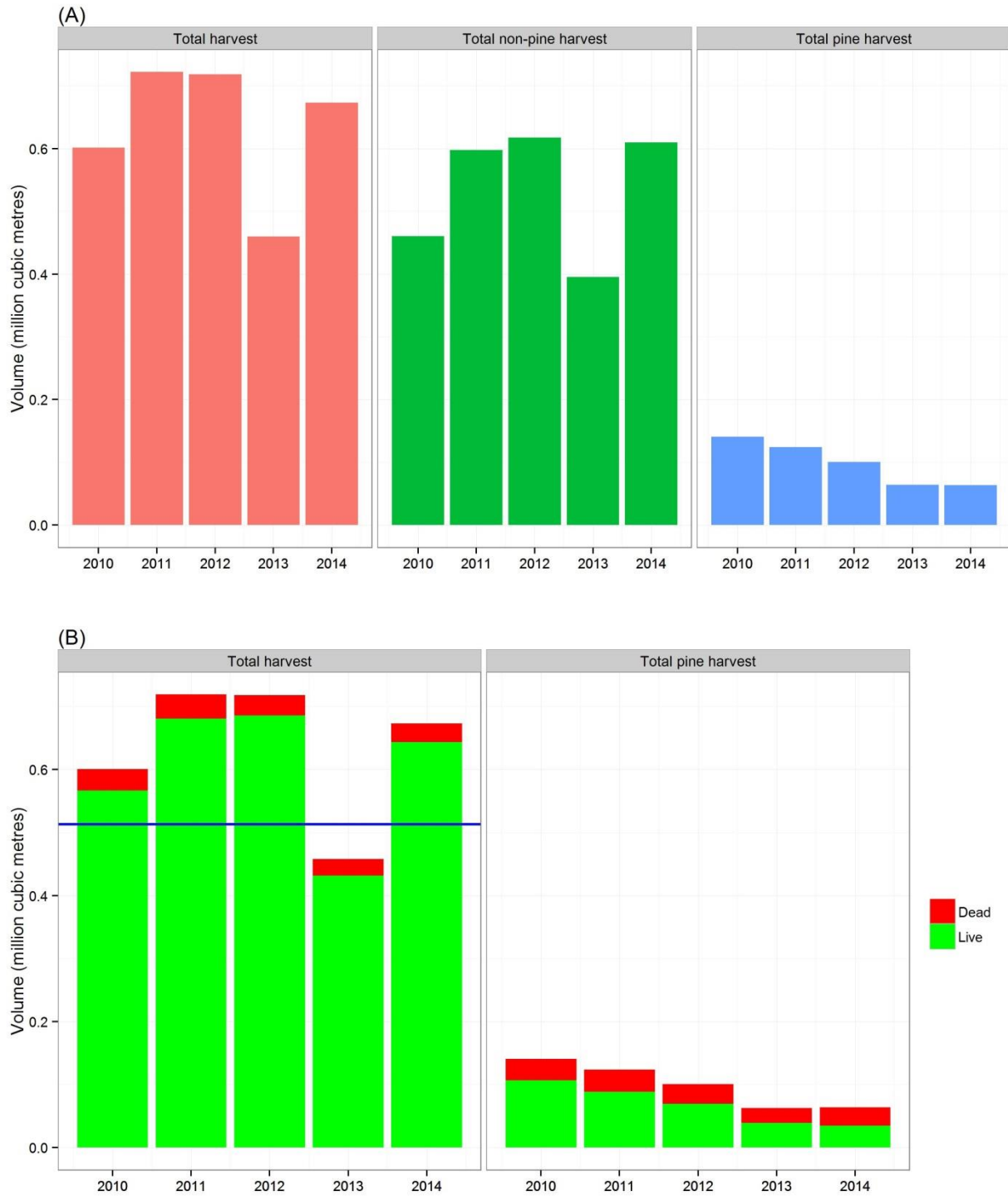


Figure 19. Harvest summary for the Arrow TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

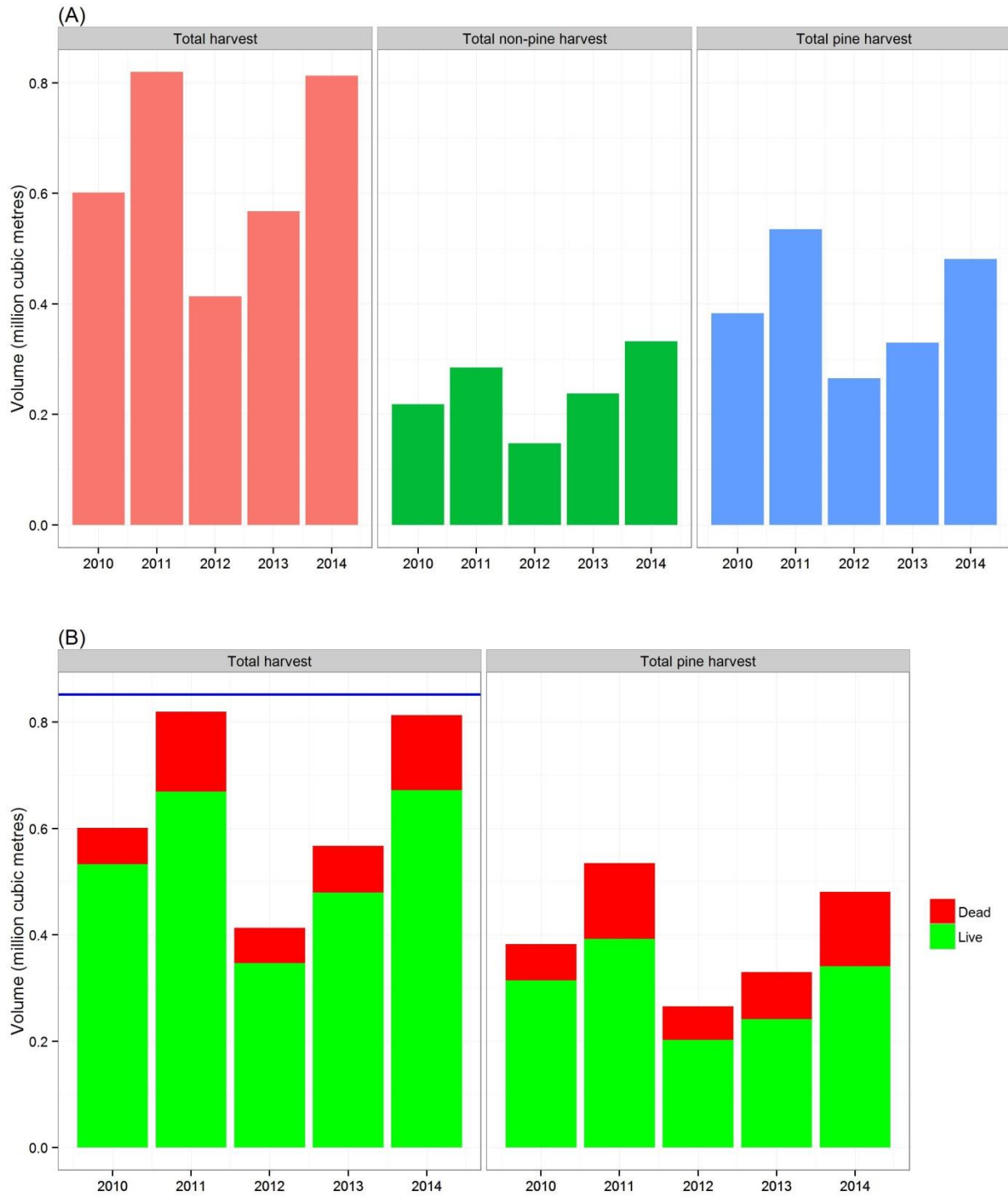


Figure 20. Harvest summary for the Bulkley TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

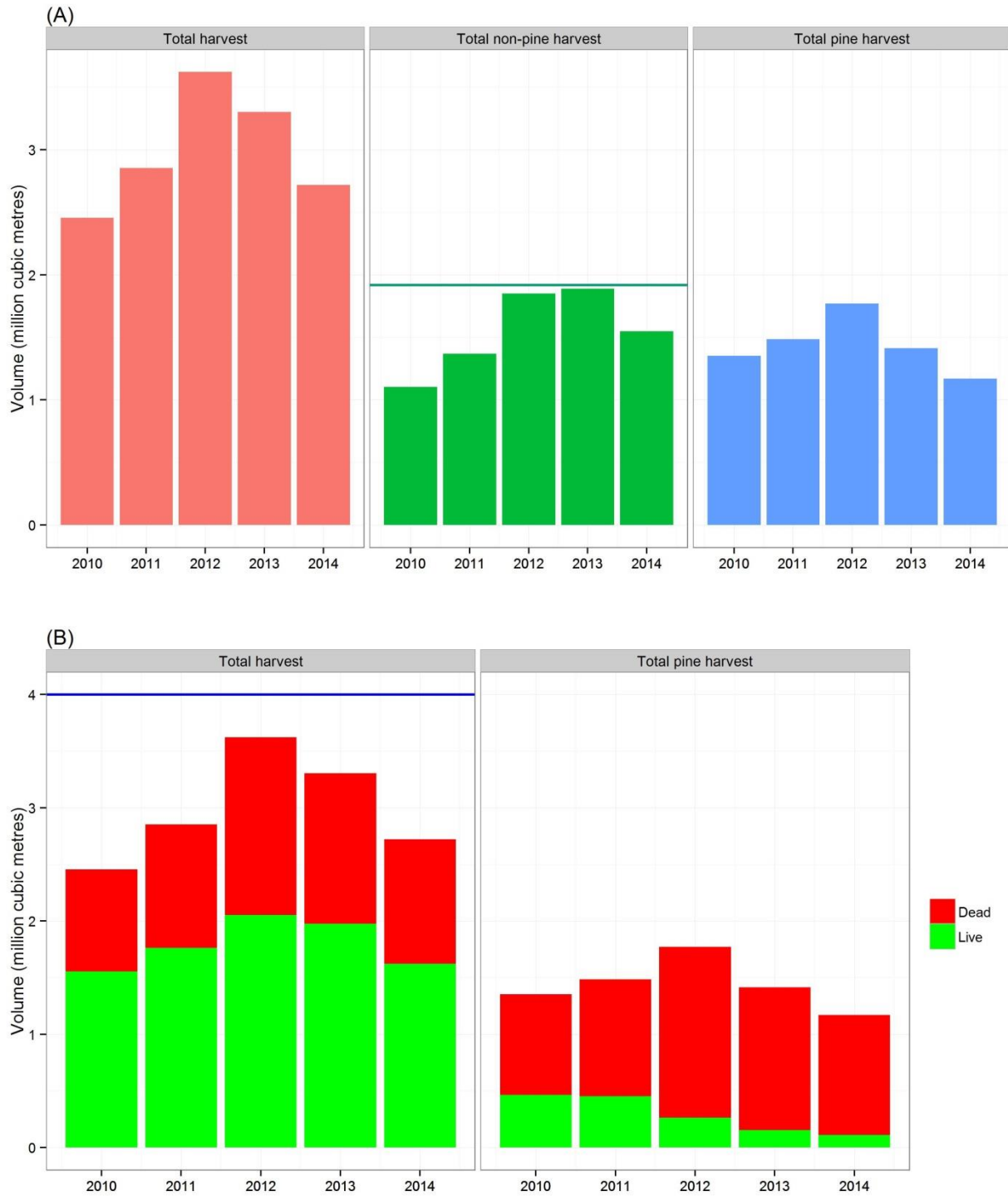


Figure 21. Harvest summary for the Kamloops TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The green line in (A) indicates the non-pine partition level while the blue line in (B) represents the AAC level.

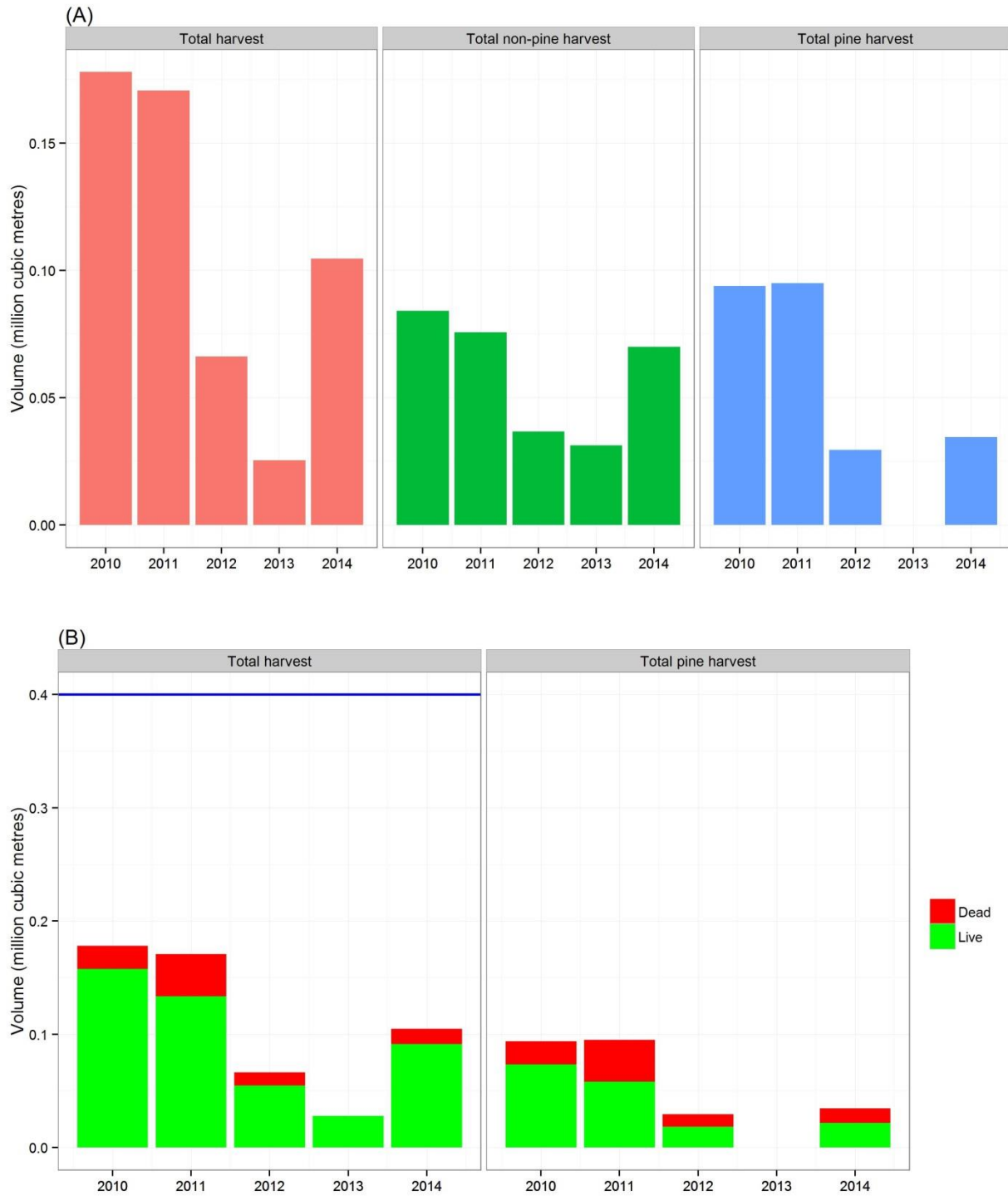


Figure 22. Harvest summary for the Robson Valley TSA: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

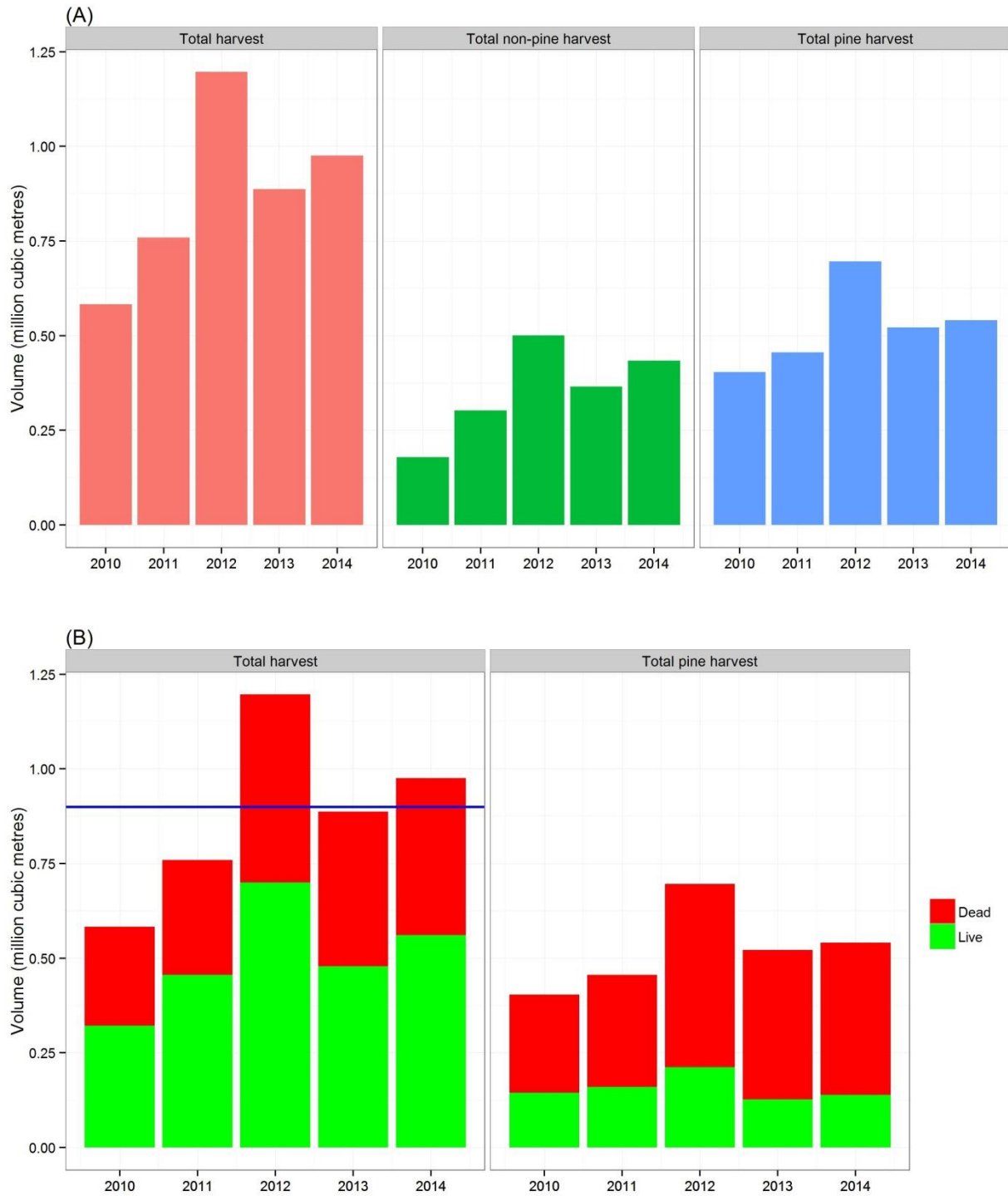


Figure 23. Harvest summary for the TFL 48 Chetwynd: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

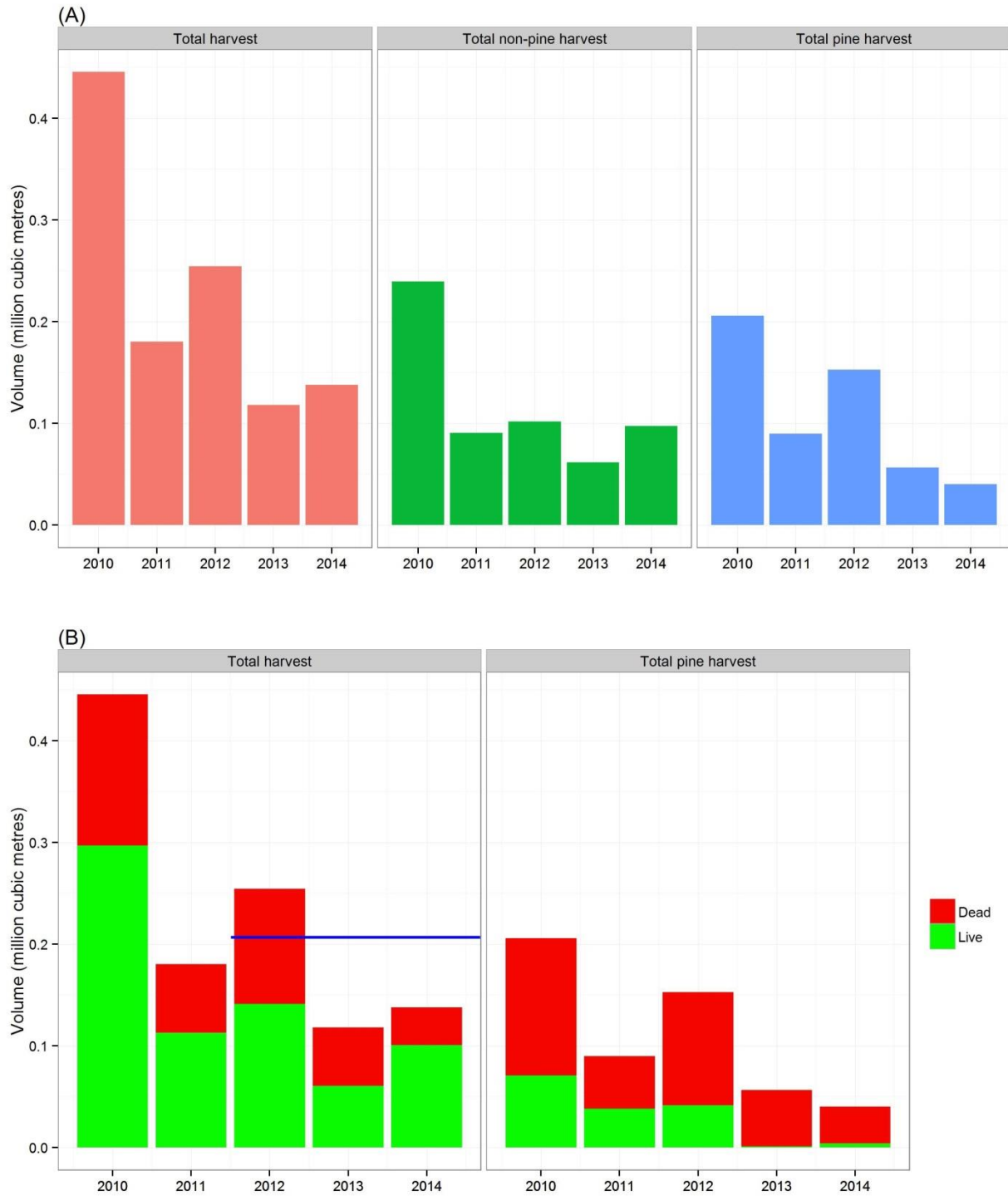


Figure 24. Harvest summary for the TFL 49 Okanagan: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

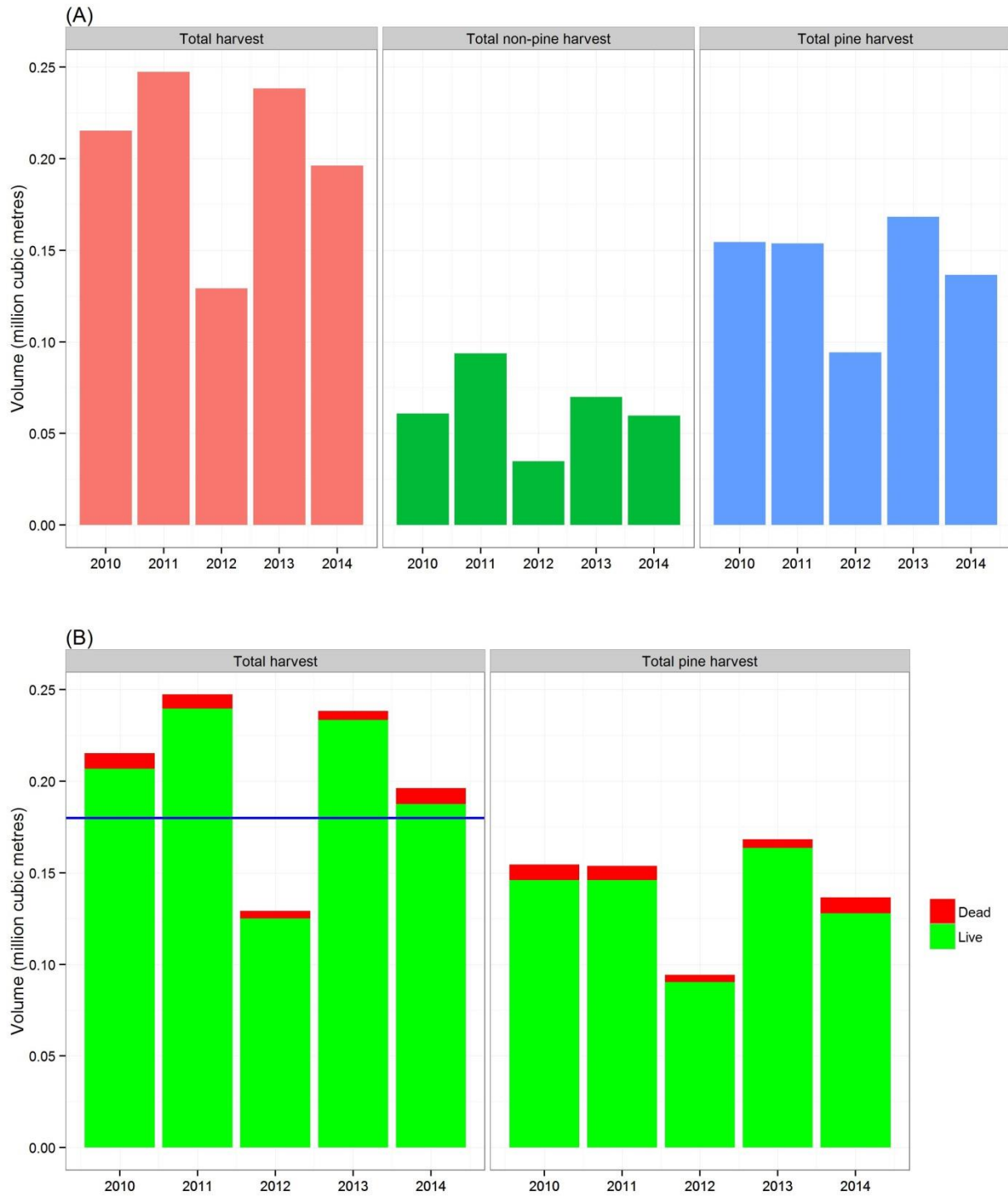


Figure 25. Harvest summary for the TFL 14 Spillimacheen: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

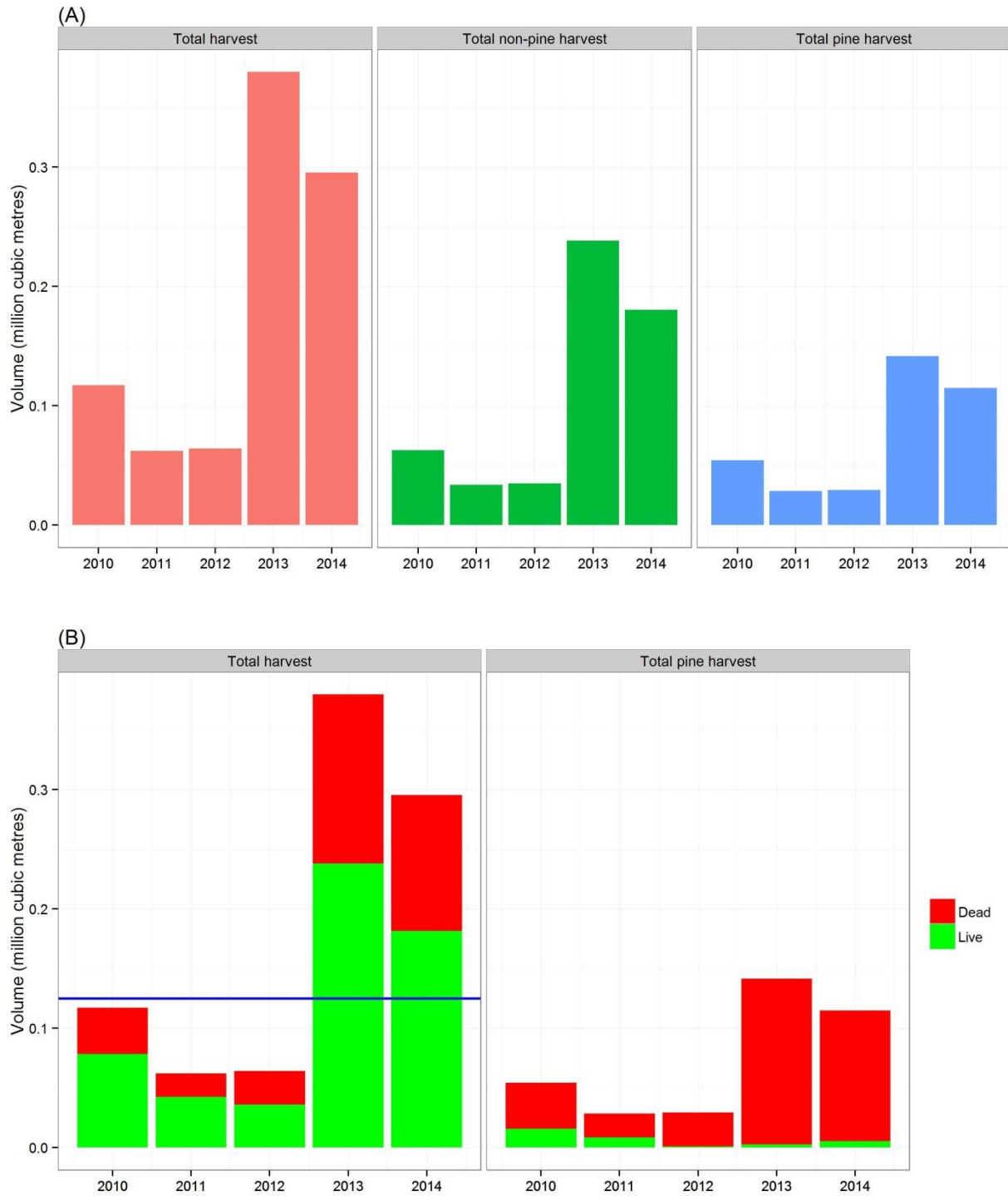


Figure 26. Harvest summary for the TFL 35 Jamieson Ck: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

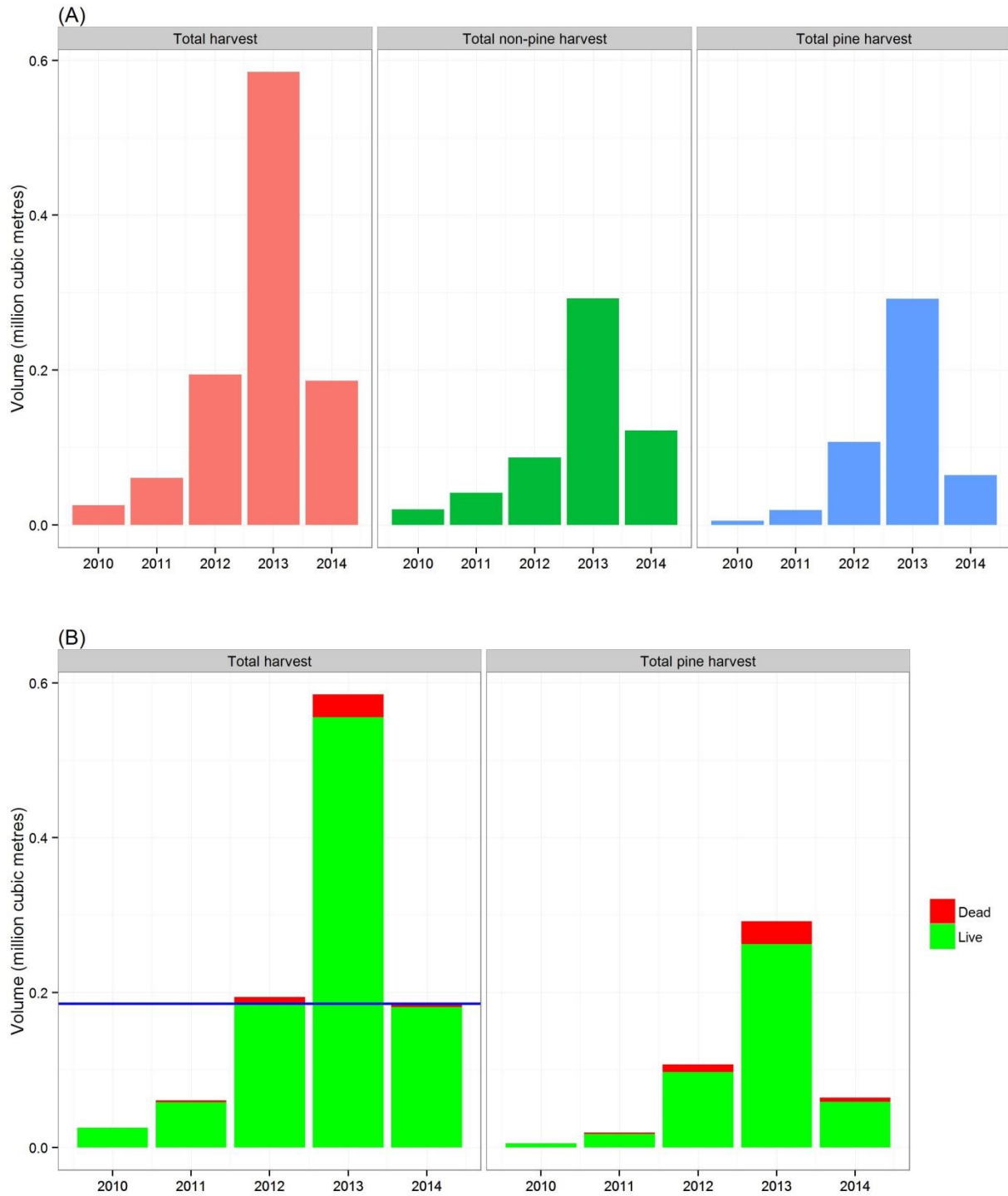


Figure 27. Harvest summary for the TFL 08 Boundary: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

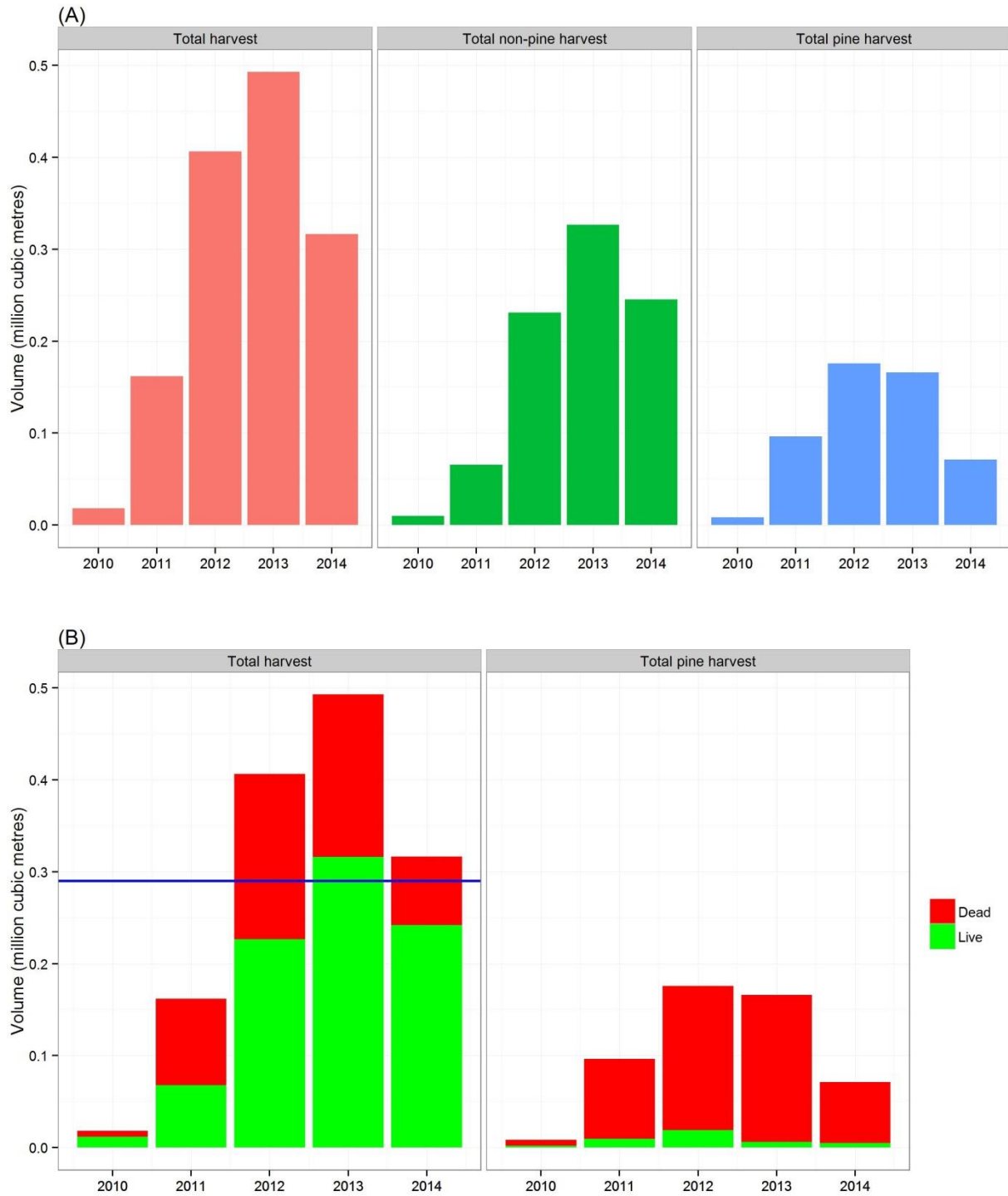


Figure 28. Harvest summary for the TFL 18 Clearwater: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

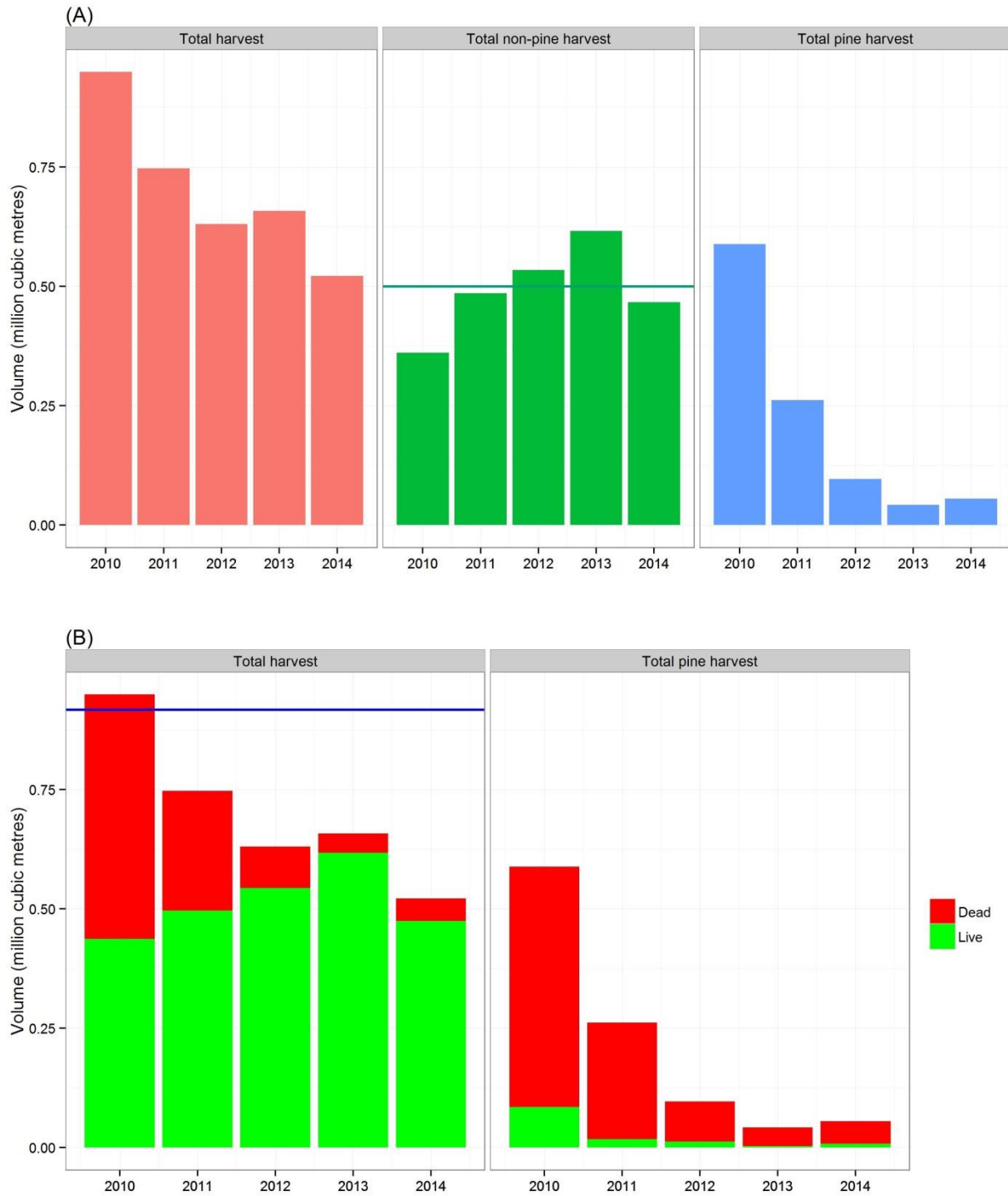


Figure 29. Harvest summary for the TFL 52 Bowron-Cottonwood: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The green line in (A) indicates the non-pine partition level while the blue line in (B) represents the AAC level.

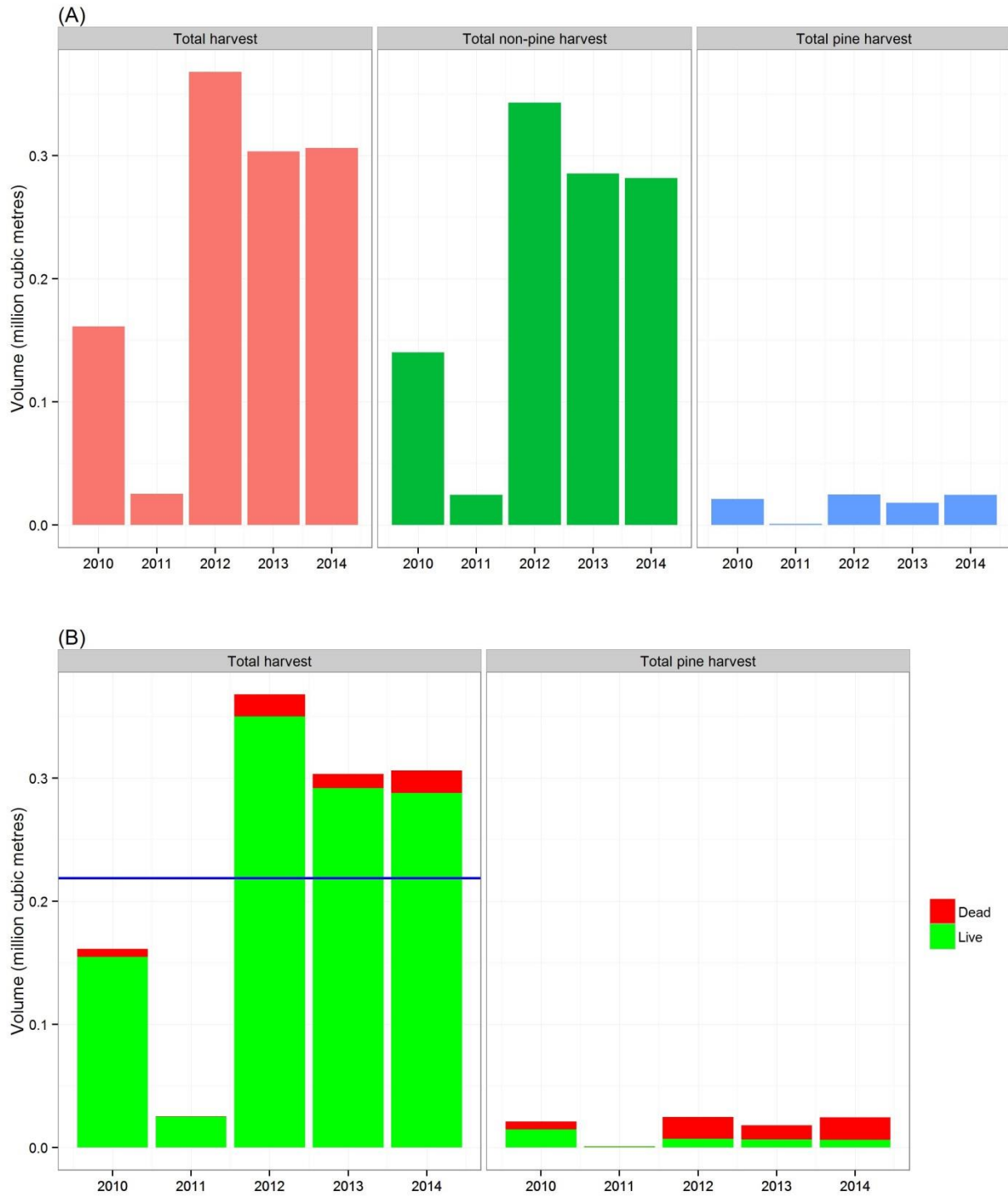


Figure 30. Harvest summary for the TFL 53 Naver: (A) Total harvest, total non-pine harvest, and total pine harvest; (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

Table 1. Percentages of pine in total harvest

Management unit (MU)	% of pine volume in MU	Live and dead pine volume remaining in MU (million m ³)	% of pine in total harvest				
			2010	2011	2012	2013	2014
Lakes TSA	63.4	46.6	81.0	72.9	78.6	74.7	70.6
Quesnel TSA	57.6	55.6	83.1	83.5	85.3	86.0	82.8
Cranbrook TSA	51.7	24.6	67.6	65.2	62.6	65.1	56.6
Williams Lake TSA	48.8	69.3	70.8	69.0	69.4	70.1	69.8
Merritt TSA	47.3	38.6	73.7	74.9	71.6	69.8	71.1
Boundary TSA	45.8	14.7	38.9	60.4	63.5	50.8	52.0
Mackenzie TSA	44.8	115.8	70.5	72.7	64.5	62.4	61.5
Prince George TSA	42.6	197.7	70.2	64.7	64.6	60.8	61.3
Morice TSA	42.4	42.7	74.4	64.6	59.6	61.4	67.5
Invermere TSA	40.4	10.3	64.0	56.7	42.3	37.8	36.7
Lillooet TSA	37.3	13.1	28.8	29.3	14.8	41.1	30.0
100 Mile House TSA	33.4	17.6	78.2	78.8	68.7	66.9	59.7
Dawson Creek TSA	27.6	33.9	33.7	42.2	50.9	49.6	49.3
Kootenay Lake TSA	19.4	7.5	45.3	43.0	40.6	29.6	27.3
Okanagan TSA	18.5	22.4	57.4	52.7	42.8	34.8	35.7
Golden TSA	18.5	4.5	28.0	25.6	17.3	15.0	11.7
Arrow TSA	17.9	8.0	23.4	17.2	14.0	14.0	9.4
Bulkley TSA	16.8	9.7	63.6	65.3	64.2	58.1	59.2
Kamloops TSA	15.2	18.9	55.1	52.1	48.9	42.8	43.1
Robson Valley TSA	12.4	3.3	52.7	55.6	44.5	NA ^a	33.1
TFL 48 Chetwynd	33.8	16.9	69.3	60.1	58.2	58.8	55.5
TFL 49 Okanagan	32.1	4.0	46.2	49.9	60.0	47.8	29.3
TFL 14 Spillimacheen	32.1	1.7	71.7	62.1	73.0	70.7	69.6
TFL 35 Jamieson Ck	25.0	0.6	46.4	45.6	45.5	37.3	38.9
TFL 08 Boundary	24.8	1.9	21.1	31.9	55.2	50.0	34.5
TFL 18 Clearwater	21.9	1.0	45.3	59.5	43.2	33.7	22.5
TFL 52 Bowron-Cottonwood	18.0	3.9	62.0	35.0	15.3	6.4	10.6
TFL 53 Naver	13.2	0.9	13.1	3.8	6.8	5.9	8.0

a. The total pine harvest was reported to a negative value and is therefore assumed to be zero. The management units are in descending order based on the percentage of pine volume in MU.

Table 2. Percentages of dead pine in total pine harvest.

Management unit (MU)	% dead pine volume in MU	Accessible volume remaining in stands >70% dead in MU (million m ³) ^b	% of dead pine in total pine harvest				
			2010	2011	2012	2013	2014
Lakes TSA	77.7	15.7	77.1	80.4	93.4	96.8	89.5
Quesnel TSA	74.2	26.2	72.2	83.6	87.8	91.0	91.3
Cranbrook TSA	10.4	0.09	10.4	16.0	10.0	10.4	10.7
Williams Lake TSA	56.1	15.3	60.3	75.6	74.6	73.6	82.9
Merritt TSA	28.7	0.7	54.2	54.5	61.0	59.7	55.2
Boundary TSA	7.0	0.01	10.2	12.8	12.1	15.2	10.6
Mackenzie TSA	67.0	21.7	55.3	62.3	79.7	88.5	90.4
Prince George TSA	71.3	57.3	81.6	89.3	92.9	93.4	91.4
Morice TSA	61.2	4.5	63.8	54.0	67.5	65.3	64.8
Invermere TSA	18.1	0.2	12.5	16.9	20.3	19.5	19.5
Lillooet TSA	26.6	0.1	64.0	68.1	44.3	53.4	70.2
100 Mile House TSA	68.9	5.6	67.0	89.6	96.9	96.4	99.5
Dawson Creek TSA	42.8	1.7	60.1	54.7	60.3	68.2	72.4
Kootenay Lake TSA	15.0	0	8.4	7.0	6.3	7.3	4.6
Okanagan TSA	18.8	0.1	39.2	42.0	35.5	33.7	36.6
Golden TSA	18.6	0.04	15.8	16.6	16.0	20.3	32.5
Arrow TSA	31.1	0.1	24.3	28.5	31.0	36.6	45.8
Bulkley TSA	48.2	0.2	17.9	26.7	23.8	26.7	29.1
Kamloops TSA	61.6	1.6	65.7	69.5	85.2	89.2	90.5
Robson Valley TSA	46.7	0.05	21.8	38.9	38.0	NA ^a	37.6
TFL 48 Chetwynd	67.3	NA	64.2	64.9	69.6	75.7	74.3
TFL 49 Okanagan	38.6	NA	65.6	57.7	72.9	98.0	90.0
TFL 14 Spillimacheen	10.3	NA	5.5	5.0	4.3	2.9	6.3
TFL 35 Jamieson Ck	52.6	NA	71.2	69.8	96.6	98.2	95.4
TFL 08 Boundary	7.4	NA	0.2	10.8	9.2	10.1	7.9
TFL 18 Clearwater	54.2	NA	77.9	90.1	89.3	96.3	93.2
TFL 52 Bowron-Cottonwood	79.2	NA	85.6	93.2	86.9	92.5	85.6
TFL 53 Naver	70.7	NA	31.4	46.9	72.0	63.7	74.2

a) The total pine harvest was reported to a negative value and is therefore assumed to be zero.

b) Live and dead volume in stands > 70% dead, > age 60 years in the THLB with low (community watersheds, VQO maximum modification) or no harvesting constraints.