Annex 3A. Enteric Fermentation (IPCC 3A1)
to the Technical Support Document for the 2000-2012 California's Greenhouse Gas Emissions Inventory

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Variables Used in the Emissions Estimation Equations

Values last updated on Monday, March 24, 2014

IPCC category = 3A1ai — Livestock - Enteric Fermentation - Cattle - Dairy Cows

Activity = Livestock population - Dairy calves

- Variable Name -	- Year -	- Value and Units -	- Reference -
Livestock population - Dairy calves	2000	803,368 head	Model, see text
Livestock population - Dairy calves	2001	801,128 head	Model, see text
Livestock population - Dairy calves	2002	830,446 head	Model, see text
Livestock population - Dairy calves	2003	859,292 head	Model, see text
Livestock population - Dairy calves	2004	874,145 head	Model, see text
Livestock population - Dairy calves	2005	894,484 head	Model, see text
Livestock population - Dairy calves	2006	909,920 head	Model, see text
Livestock population - Dairy calves	2007	920,516 head	Model, see text
Livestock population - Dairy calves	2008	944,511 head	Model, see text
Livestock population - Dairy calves	2009	944,483 head	Model, see text
Livestock population - Dairy calves	2010	903,970 head	Model, see text
Livestock population - Dairy calves	2011	900,041 head	Model, see text
Livestock population - Dairy calves	2012	920,353 head	Model, see text

Activity = Livestock population - Dairy cows

- Variable Name -	- Year -	- Value and Units -	- Reference -
Livestock population - Dairy cows	2000	1,490,000 head	Model, see text
Livestock population - Dairy cows	2001	1,560,000 head	Model, see text
Livestock population - Dairy cows	2002	1,620,000 head	Model, see text
Livestock population - Dairy cows	2003	1,670,000 head	Model, see text
Livestock population - Dairy cows	2004	1,700,000 head	Model, see text
Livestock population - Dairy cows	2005	1,740,000 head	Model, see text
Livestock population - Dairy cows	2006	1,770,000 head	Model, see text
Livestock population - Dairy cows	2007	1,790,000 head	Model, see text
Livestock population - Dairy cows	2008	1,835,000 head	Model, see text
Livestock population - Dairy cows	2009	1,840,000 head	Model, see text
Livestock population - Dairy cows	2010	1,760,000 head	Model, see text
Livestock population - Dairy cows	2011	1,750,000 head	Model, see text
Livestock population - Dairy cows	2012	1,780,000 head	Model, see text

Activity = Livestock population - Dairy replacements 0-12 months

- Variable Name -	- Year -	- Value and Units -	- Reference -
Livestock population - Dairy replacements 0-12 months	2000	215,324 head	Model, see text
Livestock population - Dairy replacements 0-12 months	2001	221,687 head	Model, see text
Livestock population - Dairy replacements 0-12 months	2002	230,021 head	Model, see text
Livestock population - Dairy replacements 0-12 months	2003	229,605 head	Model, see text
Livestock population - Dairy replacements 0-12 months	2004	219,445 head	Model, see text
Livestock population - Dairy replacements 0-12 months	2005	232,037 head	Model, see text
Livestock population - Dairy replacements 0-12 months	2006	234,693 head	Model, see text
Livestock population - Dairy replacements 0-12 months	2007	237,345 head	Model, see text
Livestock population - Dairy replacements 0-12 months	2008	236,269 head	Model, see text

Livestock population - Dairy replacements 0-12 months	2009	234,800 head	Model, see text
Livestock population - Dairy replacements 0-12 months	2010	223,269 head	Model, see text
Livestock population - Dairy replacements 0-12 months	2011	226,652 head	Model, see text
Livestock population - Dairy replacements 0-12 months	2012	245,322 head	Model, see text

Activity = Livestock population - Dairy replacements 12-24 months

- Variable Name -	- Year -	- Value and Units -	- Reference -
Livestock population - Dairy replacements 12-24 months	2000	506,204 head	Model, see text
Livestock population - Dairy replacements 12-24 months	2001	526,060 head	Model, see text
Livestock population - Dairy replacements 12-24 months	2002	540,896 head	Model, see text
Livestock population - Dairy replacements 12-24 months	2003	552,586 head	Model, see text
Livestock population - Dairy replacements 12-24 months	2004	513,355 head	Model, see text
Livestock population - Dairy replacements 12-24 months	2005	536,254 head	Model, see text
Livestock population - Dairy replacements 12-24 months	2006	554,506 head	Model, see text
Livestock population - Dairy replacements 12-24 months	2007	555,929 head	Model, see text
Livestock population - Dairy replacements 12-24 months	2008	561,165 head	Model, see text
Livestock population - Dairy replacements 12-24 months	2009	548,587 head	Model, see text
Livestock population - Dairy replacements 12-24 months	2010	526,699 head	Model, see text
Livestock population - Dairy replacements 12-24 months	2011	533,985 head	Model, see text
Livestock population - Dairy replacements 12-24 months	2012	588,161 head	Model, see text

IPCC category = 3A1aii — Livestock - Enteric Fermentation - Cattle - Other Cattle

Activity = Livestock population - Beef calves

- Variable Name -	- Year -	- Value and Units -	- Reference -
Livestock population - Beef calves	2000	410,137 head	Model, see text
Livestock population - Beef calves	2001	408,888 head	Model, see text
Livestock population - Beef calves	2002	401,015 head	Model, see text
Livestock population - Beef calves	2003	384,227 head	Model, see text
Livestock population - Beef calves	2004	376,549 head	Model, see text
Livestock population - Beef calves	2005	372,787 head	Model, see text
Livestock population - Beef calves	2006	349,617 head	Model, see text
Livestock population - Beef calves	2007	356,906 head	Model, see text
Livestock population - Beef calves	2008	327,733 head	Model, see text
Livestock population - Beef calves	2009	313,811 head	Model, see text
Livestock population - Beef calves	2010	311,949 head	Model, see text
Livestock population - Beef calves	2011	307,194 head	Model, see text
Livestock population - Beef calves	2012	312,208 head	Model, see text

Activity = Livestock population - Beef cows

- Variable Name -	- Year -	- Value and Units -	- Reference -
Livestock population - Beef cows	2000	790,000 head	Model, see text
Livestock population - Beef cows	2001	780,000 head	Model, see text
Livestock population - Beef cows	2002	760,000 head	Model, see text
Livestock population - Beef cows	2003	740,000 head	Model, see text

Livestock population - Beef cows	2004	720,000 head	Model, see text
Livestock population - Beef cows	2005	720,000 head	Model, see text
Livestock population - Beef cows	2006	680,000 head	Model, see text
Livestock population - Beef cows	2007	700,000 head	Model, see text
Livestock population - Beef cows	2008	655,000 head	Model, see text
Livestock population - Beef cows	2009	620,000 head	Model, see text
Livestock population - Beef cows	2010	610,000 head	Model, see text
Livestock population - Beef cows	2011	600,000 head	Model, see text
Livestock population - Beef cows	2012	620,000 head	Model, see text

Activity = Livestock population - Beef replacements 0-12 months

- Variable Name -	- Year -	- Value and Units -	- Reference -
Livestock population - Beef replacements 0-12 months	2000	34,591 head	Model, see text
Livestock population - Beef replacements 0-12 months	2001	32,963 head	Model, see text
Livestock population - Beef replacements 0-12 months	2002	32,044 head	Model, see text
Livestock population - Beef replacements 0-12 months	2003	30,245 head	Model, see text
Livestock population - Beef replacements 0-12 months	2004	29,855 head	Model, see text
Livestock population - Beef replacements 0-12 months	2005	31,438 head	Model, see text
Livestock population - Beef replacements 0-12 months	2006	28,252 head	Model, see text
Livestock population - Beef replacements 0-12 months	2007	28,903 head	Model, see text
Livestock population - Beef replacements 0-12 months	2008	25,568 head	Model, see text
Livestock population - Beef replacements 0-12 months	2009	26,827 head	Model, see text
Livestock population - Beef replacements 0-12 months	2010	27,282 head	Model, see text
Livestock population - Beef replacements 0-12 months	2011	26,320 head	Model, see text
Livestock population - Beef replacements 0-12 months	2012	26,135 head	Model, see text

Activity = Livestock population - Beef replacements 12-24 months

- Variable Name -	- Year -	- Value and Units -	- Reference -
Livestock population - Beef replacements 12-24 months	2000	81,615 head	Model, see text
Livestock population - Beef replacements 12-24 months	2001	78,674 head	Model, see text
Livestock population - Beef replacements 12-24 months	2002	75,822 head	Model, see text
Livestock population - Beef replacements 12-24 months	2003	73,047 head	Model, see text
Livestock population - Beef replacements 12-24 months	2004	70,133 head	Model, see text
Livestock population - Beef replacements 12-24 months	2005	73,112 head	Model, see text
Livestock population - Beef replacements 12-24 months	2006	67,423 head	Model, see text
Livestock population - Beef replacements 12-24 months	2007	70,179 head	Model, see text
Livestock population - Beef replacements 12-24 months	2008	61,740 head	Model, see text
Livestock population - Beef replacements 12-24 months	2009	64,408 head	Model, see text
Livestock population - Beef replacements 12-24 months	2010	67,244 head	Model, see text
Livestock population - Beef replacements 12-24 months	2011	61,857 head	Model, see text
Livestock population - Beef replacements 12-24 months	2012	61,813 head	Model, see text

Activity = Livestock population - Bulls

- Variable Name -	- Year -	- Value and Units -	- Reference -
Livestock population - Bulls	2000	70,000 head	Wirth, 2013
Livestock population - Bulls	2001	70,000 head	Wirth, 2013
Livestock population - Bulls	2002	65,000 head	Wirth, 2013
Livestock population - Bulls	2003	65,000 head	Wirth, 2013

Livestock population - Bulls	2004	65,000 head	Wirth, 2013
Livestock population - Bulls	2005	70,000 head	Wirth, 2013
Livestock population - Bulls	2006	75,000 head	Wirth, 2013
Livestock population - Bulls	2007	70,000 head	Wirth, 2013
Livestock population - Bulls	2008	70,000 head	Wirth, 2013
Livestock population - Bulls	2009	65,000 head	Wirth, 2013
Livestock population - Bulls	2010	70,000 head	Wirth, 2013
Livestock population - Bulls	2011	70,000 head	Wirth, 2013
Livestock population - Bulls	2012	70,000 head	Wirth, 2013

Activity = Livestock population - Heifer feedlot

- Variable Name -	*- Year -*	*- Value and Units -*	*- Reference -*
Livestock population - Heifer feedlot	2000	139,142 head	Model, see text
Livestock population - Heifer feedlot	2001	142,349 head	Model, see text
Livestock population - Heifer feedlot	2002	153,598 head	Model, see text
Livestock population - Heifer feedlot	2003	172,292 head	Model, see text
Livestock population - Heifer feedlot	2004	166,407 head	Model, see text
Livestock population - Heifer feedlot	2005	172,746 head	Model, see text
Livestock population - Heifer feedlot	2006	183,673 head	Model, see text
Livestock population - Heifer feedlot	2007	178,240 head	Model, see text
Livestock population - Heifer feedlot	2008	173,124 head	Model, see text
Livestock population - Heifer feedlot	2009	161,482 head	Model, see text
Livestock population - Heifer feedlot	2010	158,816 head	Model, see text
Livestock population - Heifer feedlot	2011	161,598 head	Model, see text
Livestock population - Heifer feedlot	2012	167,097 head	Model, see text

Activity = Livestock population - Heifer stockers

- Variable Name -	*- Year -*	*- Value and Units -*	*- Reference -*
Livestock population - Heifer stockers	2000	92,633 head	Model, see text
Livestock population - Heifer stockers	2001	90,215 head	Model, see text
Livestock population - Heifer stockers	2002	91,137 head	Model, see text
Livestock population - Heifer stockers	2003	87,586 head	Model, see text
Livestock population - Heifer stockers	2004	85,646 head	Model, see text
Livestock population - Heifer stockers	2005	98,337 head	Model, see text
Livestock population - Heifer stockers	2006	92,694 head	Model, see text
Livestock population - Heifer stockers	2007	85,161 head	Model, see text
Livestock population - Heifer stockers	2008	89,487 head	Model, see text
Livestock population - Heifer stockers	2009	89,269 head	Model, see text
Livestock population - Heifer stockers	2010	108,645 head	Model, see text
Livestock population - Heifer stockers	2011	106,094 head	Model, see text
Livestock population - Heifer stockers	2012	104,021 head	Model, see text

Activity = Livestock population - Steer feedlot

- Variable Name -	*- Year -*	*- Value and Units -*	*- Reference -*
Livestock population - Steer feedlot	2000	245,609 head	Model, see text
Livestock population - Steer feedlot	2001	247,533 head	Model, see text
Livestock population - Steer feedlot	2002	274,348 head	Model, see text
Livestock population - Steer feedlot	2003	310,949 head	Model, see text
Livestock population - Steer feedlot	2004	294,905 head	Model, see text
Livestock population - Steer feedlot	2005	309,666 head	Model, see text
Livestock population - Steer feedlot	2006	333,691 head	Model, see text
Livestock population - Steer feedlot	2007	326,667 head	Model, see text
Livestock population - Steer feedlot	2008	320,006 head	Model, see text
Livestock population - Steer feedlot	2009	301,790 head	Model, see text
Livestock population - Steer feedlot	2010	293,587 head	Model, see text
Livestock population - Steer feedlot	2011	294,046 head	Model, see text
Livestock population - Steer feedlot	2012	303,514 head	Model, see text

Activity = Livestock population - Steer stockers

- Variable Name -	- Year -	- Value and Units -	- Reference -
Livestock population - Steer stockers	2000	345,130 head	Model, see text
Livestock population - Steer stockers	2001	333,890 head	Model, see text
Livestock population - Steer stockers	2002	338,314 head	Model, see text
Livestock population - Steer stockers	2003	310,115 head	Model, see text
Livestock population - Steer stockers	2004	318,654 head	Model, see text
Livestock population - Steer stockers	2005	333,041 head	Model, see text
Livestock population - Steer stockers	2006	308,303 head	Model, see text
Livestock population - Steer stockers	2007	321,266 head	Model, see text
Livestock population - Steer stockers	2008	302,208 head	Model, see text
Livestock population - Steer stockers	2009	304,654 head	Model, see text
Livestock population - Steer stockers	2010	288,868 head	Model, see text
Livestock population - Steer stockers	2011	274,461 head	Model, see text
Livestock population - Steer stockers	2012	277,741 head	Model, see text

IPCC category = 3A1c — Livestock - Enteric Fermentation - Sheep

Activity = Livestock population - Sheep

- Variable Name -	- Year -	- Value and Units -	- Reference -
Livestock population - Sheep	2000	810,000 head	USDA, 2013a
Livestock population - Sheep	2001	805,000 head	USDA, 2013a
Livestock population - Sheep	2002	755,000 head	USDA, 2013a
Livestock population - Sheep	2003	730,000 head	USDA, 2013a
Livestock population - Sheep	2004	675,000 head	USDA, 2013a
Livestock population - Sheep	2005	690,000 head	USDA, 2013a
Livestock population - Sheep	2006	650,000 head	USDA, 2013a
Livestock population - Sheep	2007	610,000 head	USDA, 2013a
Livestock population - Sheep	2008	620,000 head	USDA, 2013a
Livestock population - Sheep	2009	660,000 head	USDA, 2013a
Livestock population - Sheep	2010	610,000 head	USDA, 2013a
Livestock population - Sheep	2011	600,000 head	USDA, 2013a
Livestock population - Sheep	2012	570,000 head	USDA, 2013a
CH4 emission factor	2000	8,000 g / individual	IPCC, 2006d
CH4 emission factor	2001	8,000 g / individual	IPCC, 2006d
CH4 emission factor	2002	8,000 g / individual	IPCC, 2006d
CH4 emission factor	2003	8,000 g / individual	IPCC, 2006d
CH4 emission factor	2004	8,000 g / individual	IPCC, 2006d
CH4 emission factor	2005	8,000 g / individual	IPCC, 2006d
CH4 emission factor	2006	8,000 g / individual	IPCC, 2006d
CH4 emission factor	2007	8,000 g / individual	IPCC, 2006d
CH4 emission factor	2008	8,000 g / individual	IPCC, 2006d
CH4 emission factor	2009	8,000 g / individual	IPCC, 2006d
CH4 emission factor	2010	8,000 g / individual	IPCC, 2006d
CH4 emission factor	2011	8,000 g / individual	IPCC, 2006d
CH4 emission factor	2012	8,000 g / individual	IPCC, 2006d

IPCC category = 3A1d — Livestock - Enteric Fermentation - Goats

Activity = Livestock population - Goats

- Variable Name -	- Year -	- Value and Units -	- Reference -
Livestock population - Goats	2000	82,600 head	Interpolated generic
Livestock population - Goats	2001	92,861 head	Interpolated generic
Livestock population - Goats	2002	103,122 head	USDA, 2013a
Livestock population - Goats	2003	105,698 head	Interpolated generic

Livestock population - Goats	2004	108,273 head	Interpolated generic
Livestock population - Goats	2005	116,000 head	CDFA 2012
Livestock population - Goats	2006	128,000 head	CDFA 2012
Livestock population - Goats	2007	135,500 head	CDFA 2012
Livestock population - Goats	2008	129,000 head	CDFA 2012
Livestock population - Goats	2009	136,000 head	CDFA 2012
Livestock population - Goats	2010	134,500 head	CDFA 2012
Livestock population - Goats	2011	141,500 head	CDFA 2012
Livestock population - Goats	2012	141,000 head	USDA, 2013a
CH4 emission factor	2000	5,000 g / individual	IPCC, 2006d
CH4 emission factor	2001	5,000 g / individual	IPCC, 2006d
CH4 emission factor	2002	5,000 g / individual	IPCC, 2006d
CH4 emission factor	2003	5,000 g / individual	IPCC, 2006d
CH4 emission factor	2004	5,000 g / individual	IPCC, 2006d
CH4 emission factor	2005	5,000 g / individual	IPCC, 2006d
CH4 emission factor	2006	5,000 g / individual	IPCC, 2006d
CH4 emission factor	2007	5,000 g / individual	IPCC, 2006d
CH4 emission factor	2008	5,000 g / individual	IPCC, 2006d
CH4 emission factor	2009	5,000 g / individual	IPCC, 2006d
CH4 emission factor	2010	5,000 g / individual	IPCC, 2006d
CH4 emission factor	2011	5,000 g / individual	IPCC, 2006d
CH4 emission factor	2012	5,000 g / individual	IPCC, 2006d

IPCC category = 3A1f — Livestock - Enteric Fermentation - Horses

Activity = Livestock population - Horses

- Variable Name -	*- Year -*	*- Value and Units -*	*- Reference -*
Livestock population - Horses	2000	397,753 head	Calculation, see text
Livestock population - Horses	2001	417,489 head	Calculation, see text
Livestock population - Horses	2002	455,442 head	Calculation, see text
Livestock population - Horses	2003	531,349 head	Calculation, see text
Livestock population - Horses	2004	607,257 head	Calculation, see text
Livestock population - Horses	2005	698,345 head	Calculation, see text
Livestock population - Horses	2006	721,117 head	Calculation, see text
Livestock population - Horses	2007	721,117 head	Calculation, see text
Livestock population - Horses	2008	721,117 head	Calculation, see text
Livestock population - Horses	2009	743,889 head	Calculation, see text
Livestock population - Horses	2010	759,071 head	Calculation, see text
Livestock population - Horses	2011	770,457 head	Calculation, see text
Livestock population - Horses	2012	770,457 head	Calculation, see text
CH4 emission factor	2000	18,000 g / individual	IPCC, 2006d
CH4 emission factor	2001	18,000 g / individual	IPCC, 2006d
CH4 emission factor	2002	18,000 g / individual	IPCC, 2006d
CH4 emission factor	2003	18,000 g / individual	IPCC, 2006d
CH4 emission factor	2004	18,000 g / individual	IPCC, 2006d
CH4 emission factor	2005	18,000 g / individual	IPCC, 2006d
CH4 emission factor	2006	18,000 g / individual	IPCC, 2006d
CH4 emission factor	2007	18,000 g / individual	IPCC, 2006d
CH4 emission factor	2008	18,000 g / individual	IPCC, 2006d
CH4 emission factor	2009	18,000 g / individual	IPCC, 2006d
CH4 emission factor	2010	18,000 g / individual	IPCC, 2006d
CH4 emission factor	2011	18,000 g / individual	IPCC, 2006d
CH4 emission factor	2012	18,000 g / individual	IPCC, 2006d
Ratio of California to US horse population	2000	0.0759	AHC, 2005
Ratio of California to US horse population	2001	0.0759	AHC, 2005

Ratio of California to US horse population	2002	0.0759	AHC, 2005
Ratio of California to US horse population	2003	0.0759	AHC, 2005
Ratio of California to US horse population	2004	0.0759	AHC, 2005
Ratio of California to US horse population	2005	0.0759	AHC, 2005
Ratio of California to US horse population	2006	0.0759	AHC, 2005
Ratio of California to US horse population	2007	0.0759	AHC, 2005
Ratio of California to US horse population	2008	0.0759	AHC, 2005
Ratio of California to US horse population	2009	0.0759	AHC, 2005
Ratio of California to US horse population	2010	0.0759	AHC, 2005
Ratio of California to US horse population	2011	0.0759	AHC, 2005
Ratio of California to US horse population	2012	0.0759	AHC, 2005
US horse population	2000	5,240,000 head	FAO, 2012
US horse population	2001	5,500,000 head	FAO, 2012
US horse population	2002	6,000,000 head	FAO, 2012
US horse population	2003	7,000,000 head	FAO, 2012
US horse population	2004	8,000,000 head	FAO, 2012
US horse population	2005	9,200,000 head	FAO, 2012
US horse population	2006	9,500,000 head	FAO, 2012
US horse population	2007	9,500,000 head	FAO, 2012
US horse population	2008	9,500,000 head	FAO, 2012
US horse population	2009	9,800,000 head	FAO, 2012
US horse population	2010	10,000,000 head	FAO, 2012
US horse population	2011	10,150,000 head	FAO, 2012
US horse population	2012	10,150,000 head	Assume equal to previous year

IPCC category = 3A1h — Livestock - Enteric Fermentation - Swine

Activity = Livestock population - Swine

- Variable Name -	*- Year -*	*- Value and Units -*	*- Reference -*
Livestock population - Swine	2000	150,000 head	USDA, 2013a
Livestock population - Swine	2001	110,000 head	USDA, 2013a
Livestock population - Swine	2002	150,000 head	USDA, 2013a
Livestock population - Swine	2003	135,000 head	USDA, 2013a
Livestock population - Swine	2004	140,000 head	USDA, 2013a
Livestock population - Swine	2005	145,000 head	USDA, 2013a
Livestock population - Swine	2006	145,000 head	USDA, 2013a
Livestock population - Swine	2007	155,000 head	USDA, 2013a
Livestock population - Swine	2008	80,000 head	USDA, 2013a
Livestock population - Swine	2009	100,000 head	USDA, 2013a
Livestock population - Swine	2010	105,000 head	USDA, 2013a
Livestock population - Swine	2011	105,000 head	USDA, 2013a
Livestock population - Swine	2012	105,000 head	USDA, 2013a
CH4 emission factor	2000	1,500 g / individual	IPCC, 2006d
CH4 emission factor	2001	1,500 g / individual	IPCC, 2006d
CH4 emission factor	2002	1,500 g / individual	IPCC, 2006d
CH4 emission factor	2003	1,500 g / individual	IPCC, 2006d
CH4 emission factor	2004	1,500 g / individual	IPCC, 2006d
CH4 emission factor	2005	1,500 g / individual	IPCC, 2006d
CH4 emission factor	2006	1,500 g / individual	IPCC, 2006d
CH4 emission factor	2007	1,500 g / individual	IPCC, 2006d
CH4 emission factor	2008	1,500 g / individual	IPCC, 2006d
CH4 emission factor	2009	1,500 g / individual	IPCC, 2006d
CH4 emission factor	2010	1,500 g / individual	IPCC, 2006d
CH4 emission factor	2011	1,500 g / individual	IPCC, 2006d
CH4 emission factor	2012	1,500 g / individual	IPCC, 2006d