Sediment and its sources: From Land to River to the Bay of Islands
Waitangi River catchment

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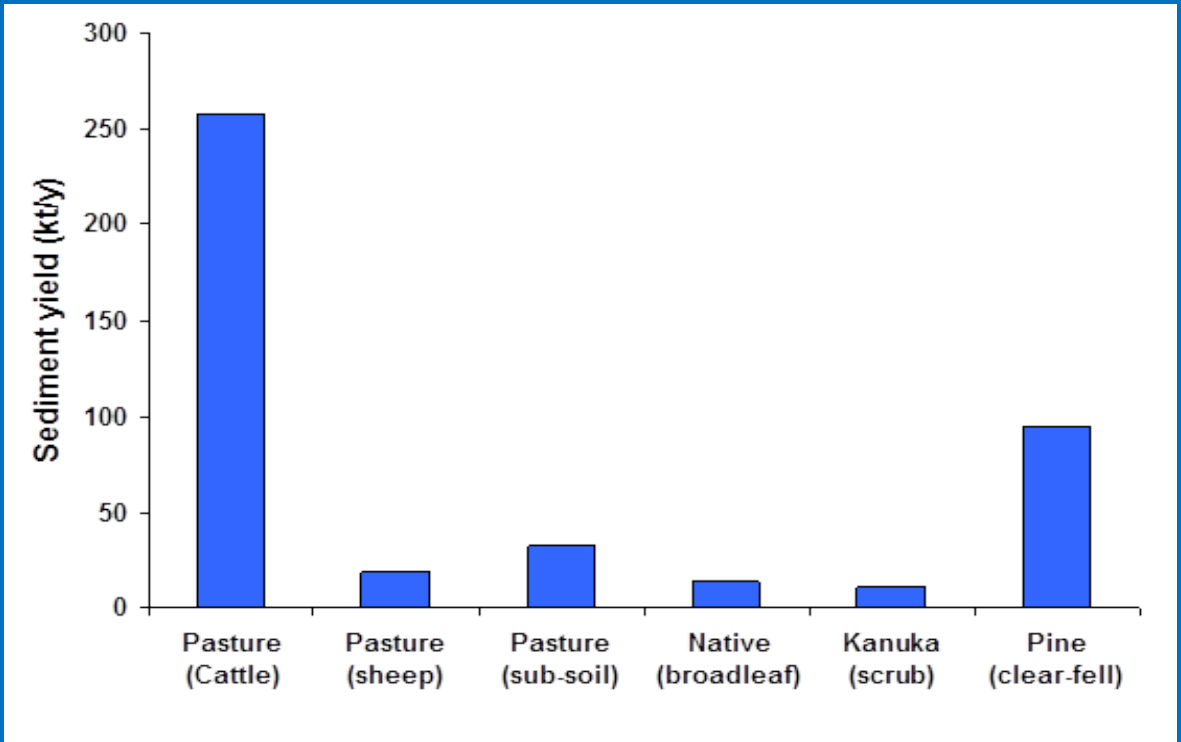
Study Objective:

1. Identify major sediment sources by land use and sub-catchment

2. Determine the sources of catchment sediments delivered to Waitangi River system at five locations down the river and in the estuary delta

Bay of Islands Oceans 2020 study:



Estimated mean annual loads (kt/y) on the Bay of Islands from land use practices as at November 2009

Bay of Islands Oceans 2020 study:

Source soil	Pasture (cattle)	Pasture (sheep)	Pasture (sub-soil)	Native (broadleaf)	Pine (clear-fell)	Kanuka (scrub)
Te Puna Inlet	27.0	32.4	<1	3.5	36.7	<1
Kerikeri Inlet	13.6	44.7	34.8	6.8	<1	<1
Waitangi Inlet	37.7	17.2	42.4	2.6	<1	<1
Kawakawa Inlet	68.3	<1	<1	2.7	27.5	1.2
Waikare Inlet	<1	<1	<1	26.6	<1	72.4

Land-use source contributions (%) to the sediment deposited in the river delta in each inlet as at November 2009

Present study – Waitangi River only:

Site Description (moving downstream)	NRC-ID	n	Proportional contribution by stream (%)			Propotional contributions by land use (%)								
			Main stem	Tributary stem	Up stream site	Bank erosion	Dairy pasture	Beef pasture	Sheep/beef pasture	Native forest	Kanuka scrubland	Pine forest	Maize cropping	Pasture Sub-soil
Northern Branch Waitangi Stream)			38	37										
Upper-Waitangi #38, above confluence	38	236							20.5	2.5			5.8	71.2
Whangai Stream (tributary #37)	37	18					4.5	17					9	69.5
Upper-Waitangi #39, below confluence	39	4	65.5	34.5			1.6	5.9	13.4	1.6			6.9	70.6
			58	62	39									
Mid-Waitangi #58 (D/S of #39)	58	5			100		2.9	11.1	7.1	0.9			7.9	70.1
Waipapa Stream (Tributary #62)	62	61					80		16	3	0.5			
Mid-Waitangi #48 (below confluence)	48	66	39	50		11	41.1	4.3	10.8	1.8	0.3	0.0	3.1	27.3
Southern branch (Waiaruhe Stream)			14	13										
Upper Waiaruhe #14 (above confluence)	14	302					71.5	7	3.5	0.5		17.5		
Puketotara Stream (Tributary #13)	13	93					63	7.5				22.5	7	
Upper Waiaruhe #15 (below confluence) (15 Calculated by 2-endmember mixing model)	15	1	91.5	8.5			70.8	7.0	3.2	0.5		17.9	0.6	
Manaia Stream (Tributary #4b)	4b	61					47		8	14.5			30.5	
			15	4b										
Waiaruhe Stream (Tributary #1)	1	12	68	2.5		25	49.3	4.8	7.0	0.7		12.2	1.2	0.1
			2	1	48									
Lower Waitangi #2, above confluence	2	187			93	15.2	38.4	4	10	1.8	0.3		5.4	25.4
Waiaruhe Stream (Tributary #1)	1	12				25	49.3	4.8	7.0	0.7		12.2	1.2	0.1
Lower Waitangi #0, Below confluence	0	9	51	41		26.0	39.8	4.0	8.0	1.1	0.1	5.0	3.2	13.0
Lower Waitangi River to Estuary				81	0									
Unnamed Tributary #81 (inflow to lower river)	81	15			59.6	55.3	24.3	2.4	4.8	0.7	0.1	3.0	1.9	7.8
Waitangi River Estuary #100	100	27		81.0	13.8	53.7	25.2	2.5	5.0	0.7	0.1	3.1	2.0	8.1
Waitangi River Estuary #101	101	3		32.1	65.1	37.5	33.7	3.4	6.7	1.0	0.2	4.2	2.7	11.0

Present study – Waitangi River only:

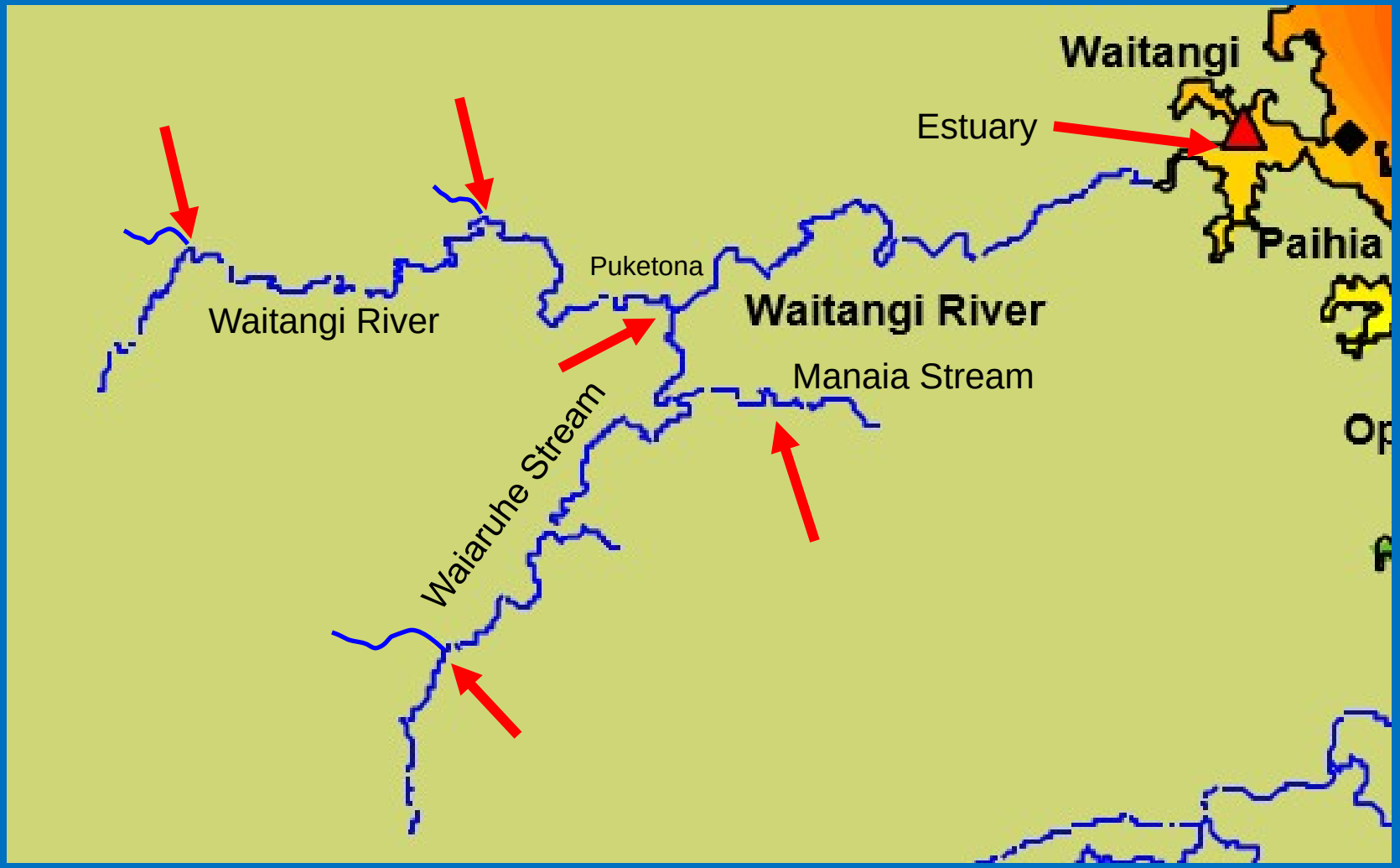
Includes bank erosion

Source soil	Pasture (cattle)	Pasture (sheep)	Pasture (sub-soil)	Native (broadleaf)	Pine (clear-fell)	Kanuka (scrub)
Waitangi Inlet (2009)	**37.7**	**17.2**	**42.4**	**2.6**	**<1**	**<1**
Waitangi Inlet (2014)	**34.7**	**5.9**	**55.1**	**0.9**	**3.7**	**<1**

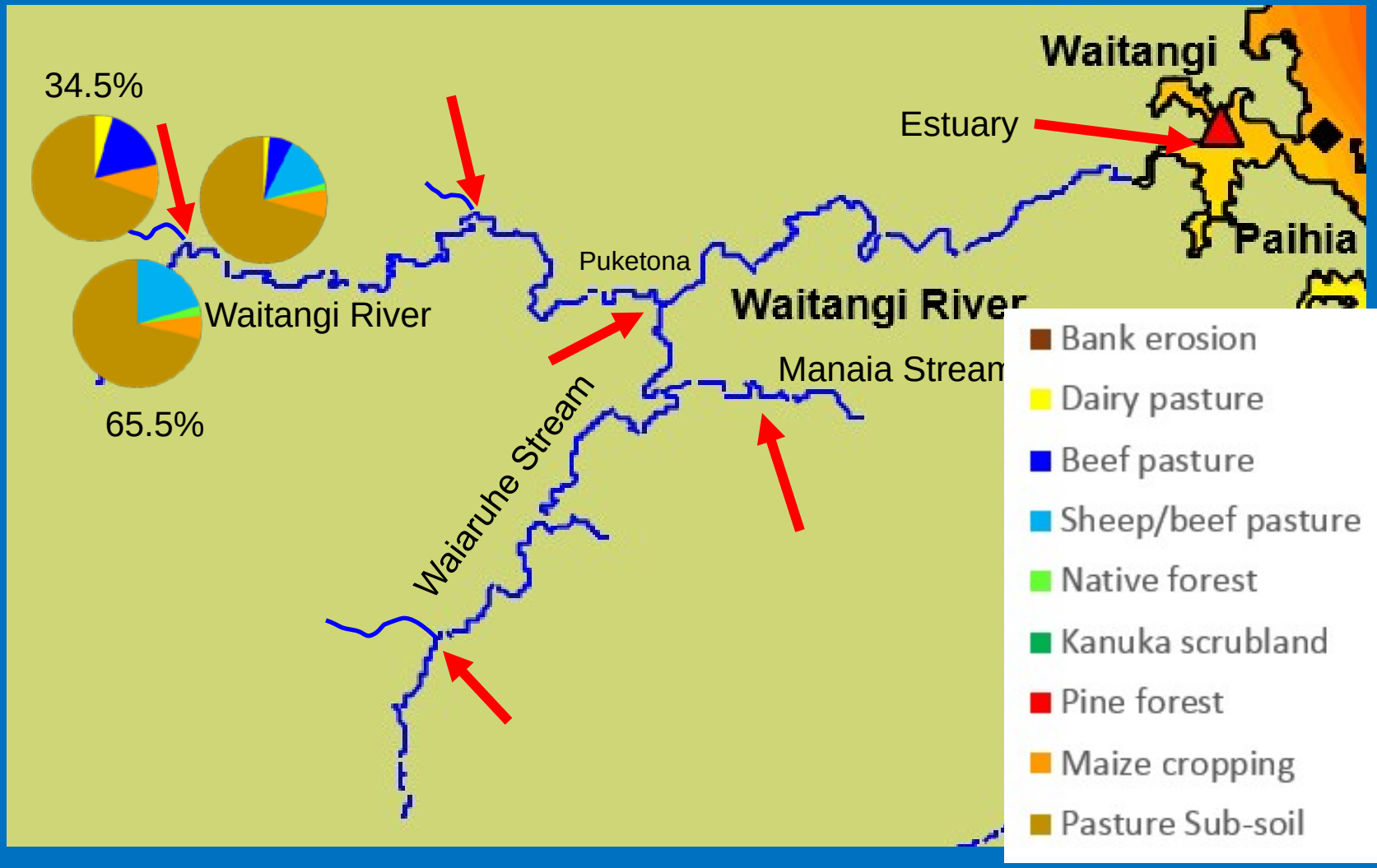
Land-use source contributions (%) to the sediment deposited in the Waitangi River delta in 2009 and 2014

Bank erosion	Dairy pasture	Beef pasture	Sheep/beef pasture	Native forest	Kanuka scrubland	Pine forest	Maize cropping	Pasture Sub-soil
45.6	29.4	2.9	5.9	0.9	0.1	3.7	2.3	9.5

Where does the sediment come from?



Sources by land use at stream confluences



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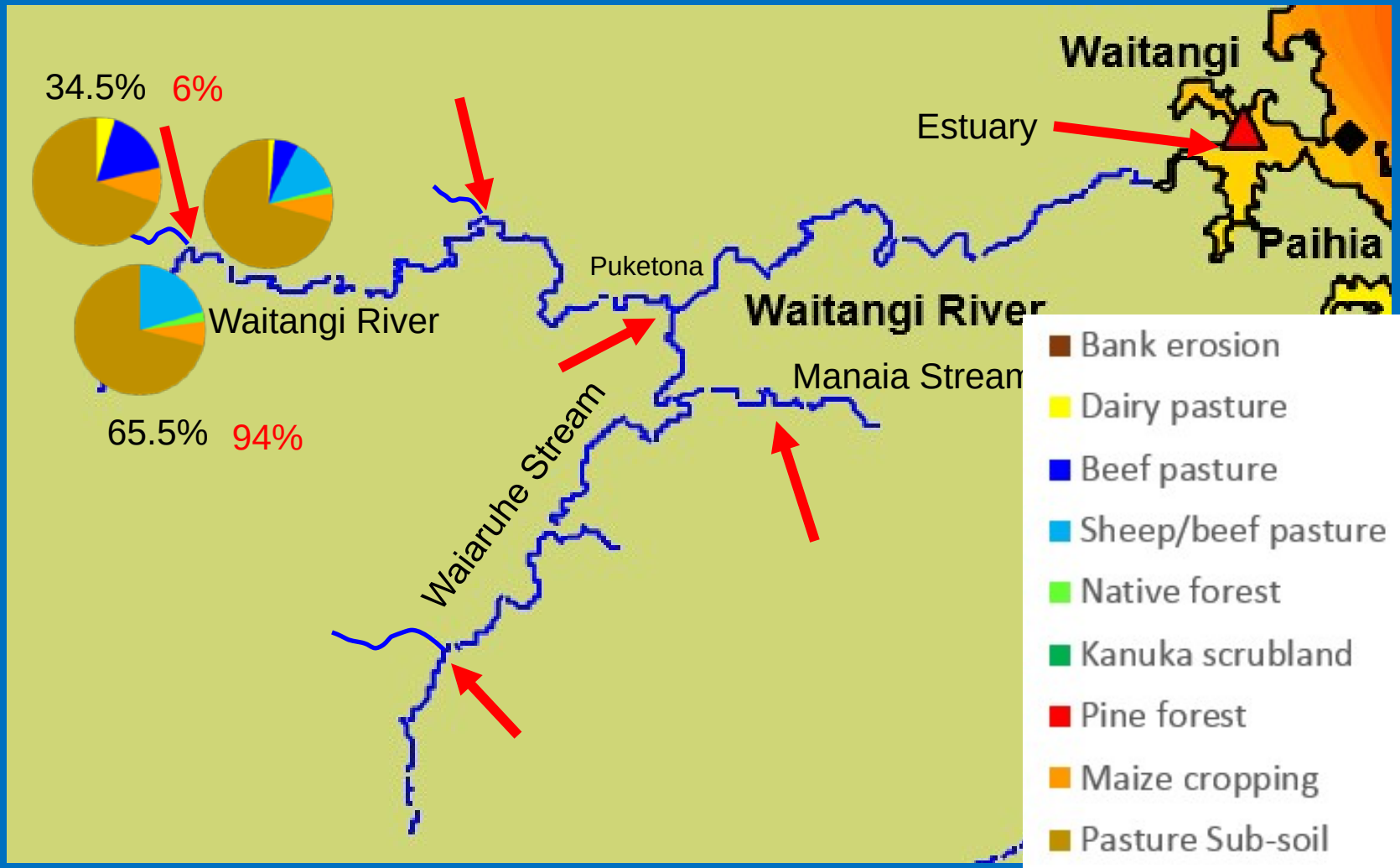

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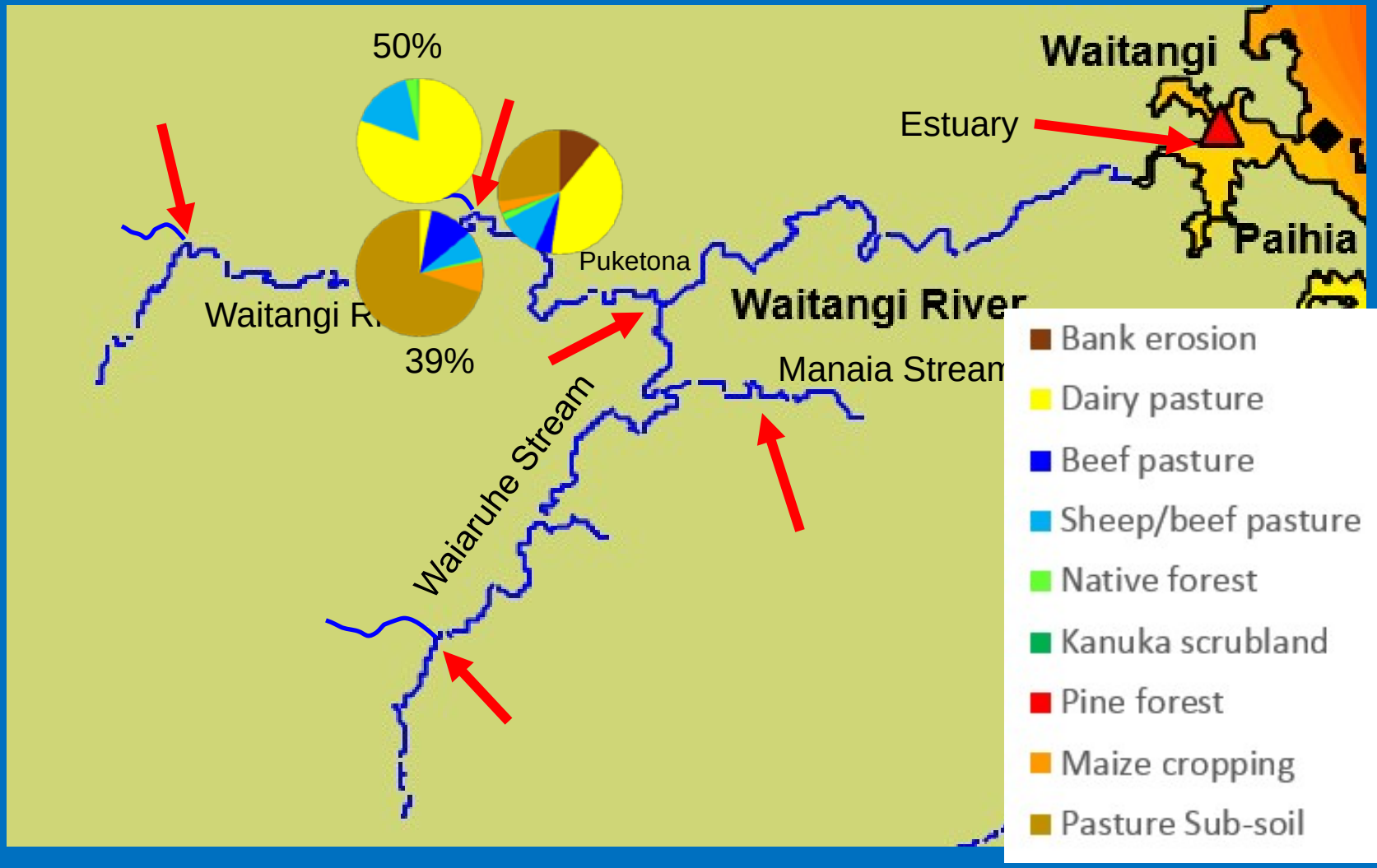

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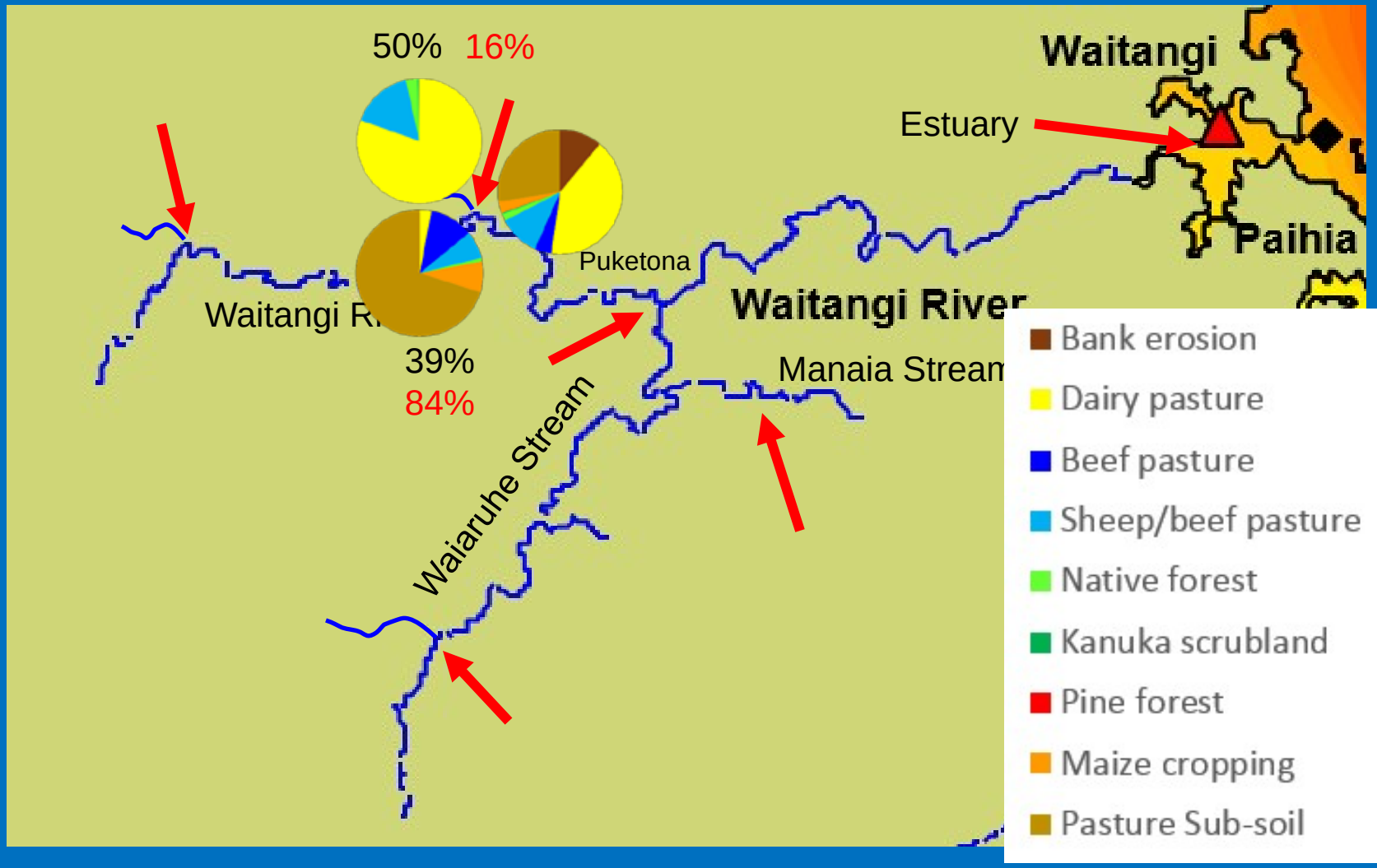

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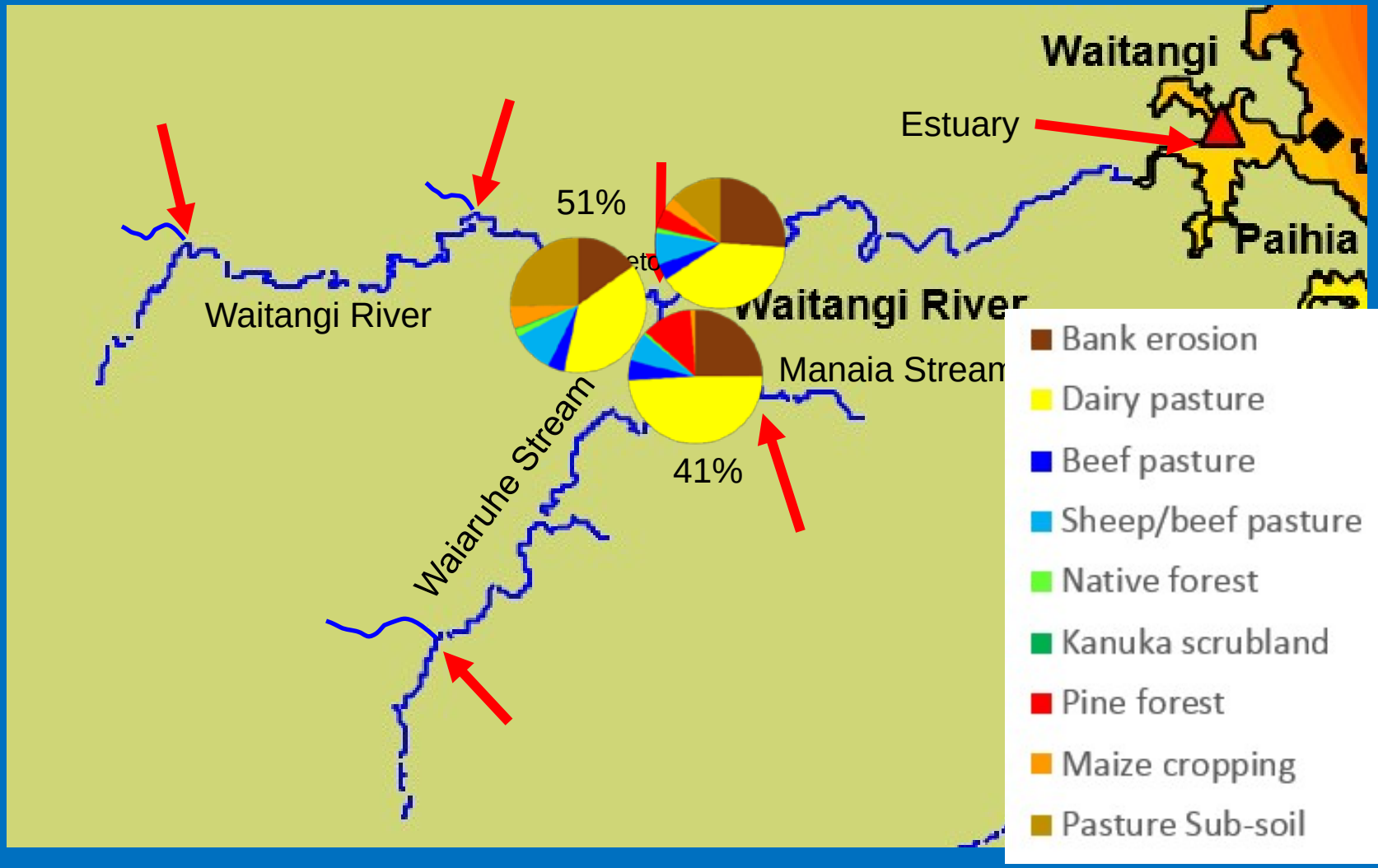

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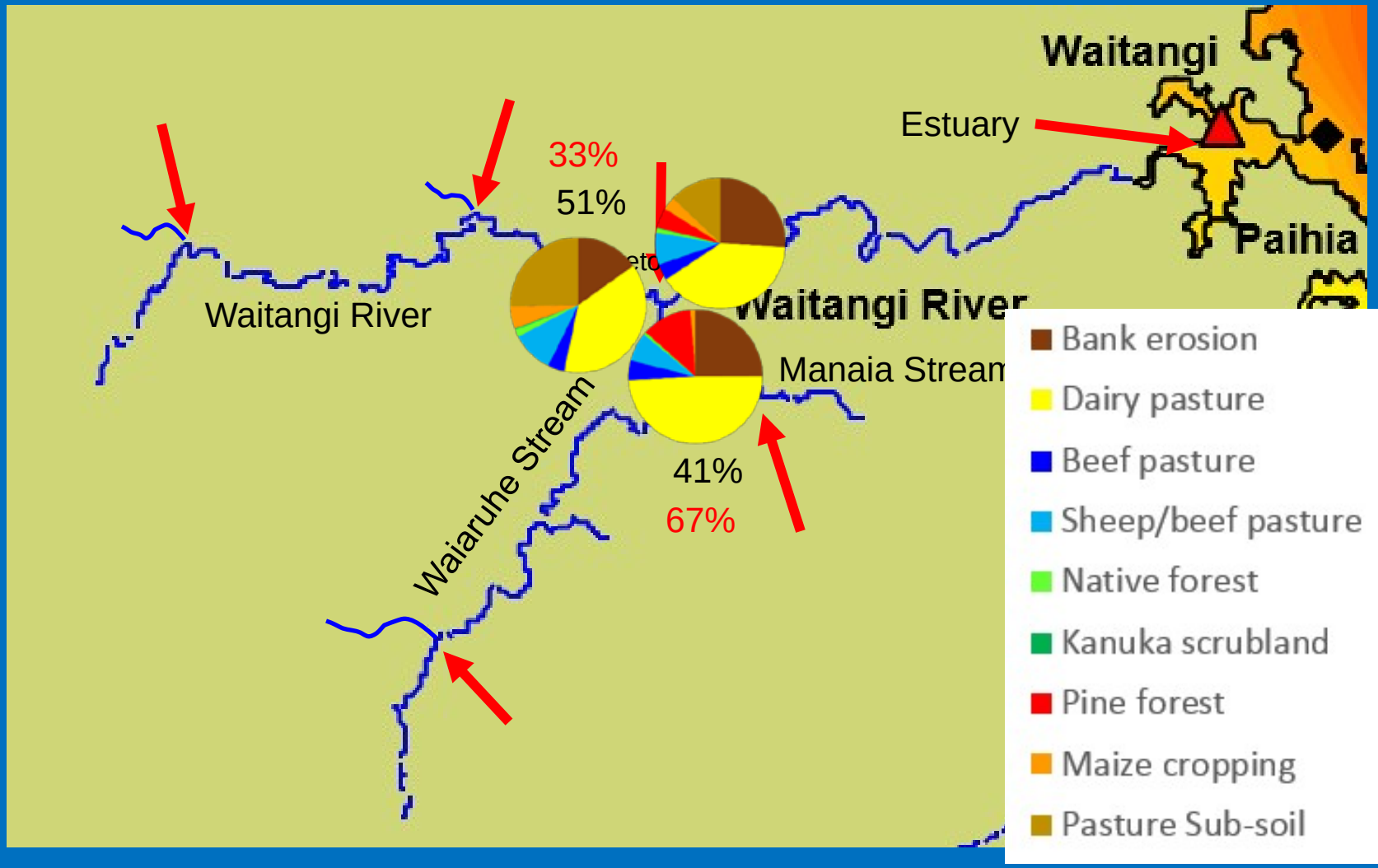

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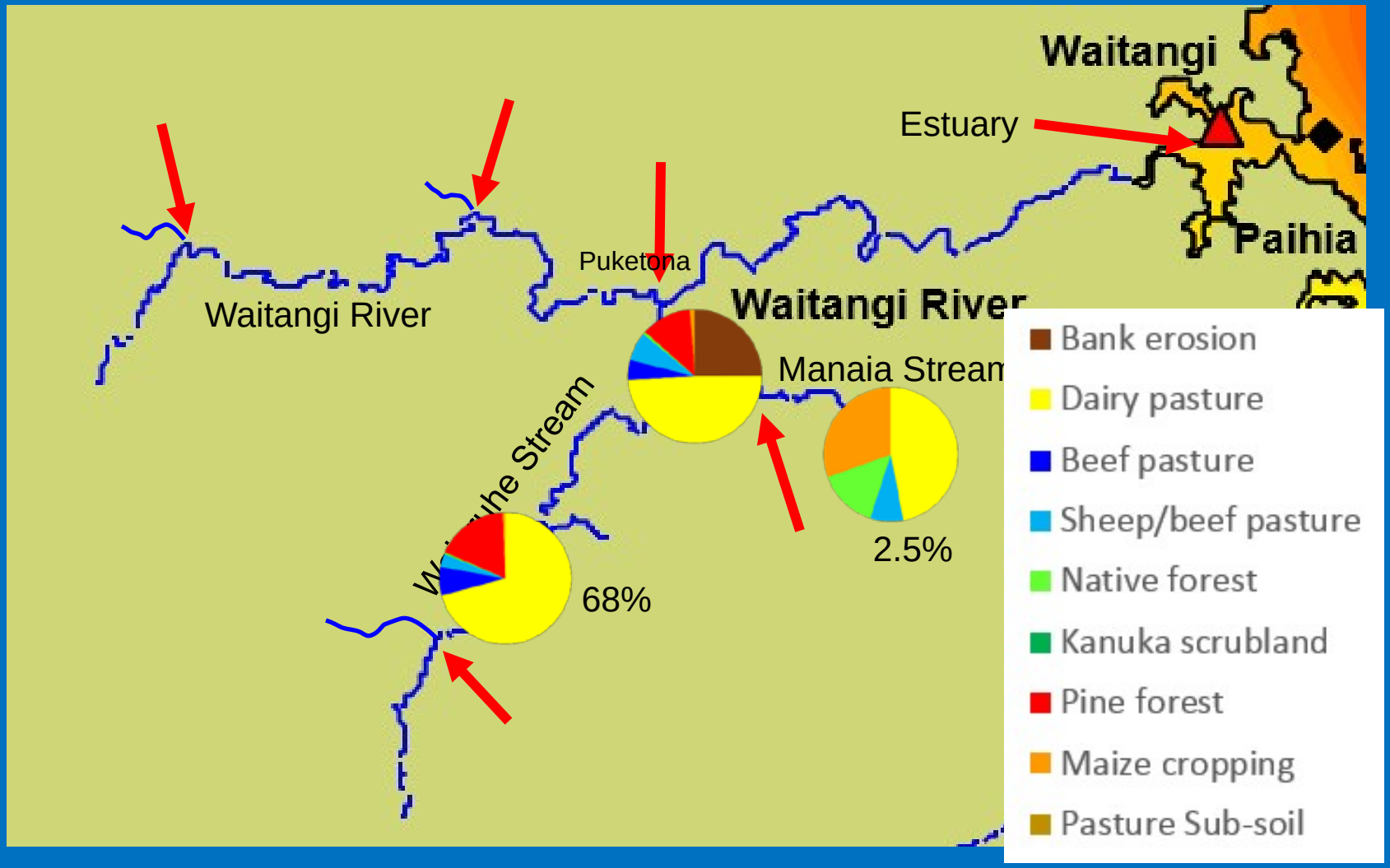

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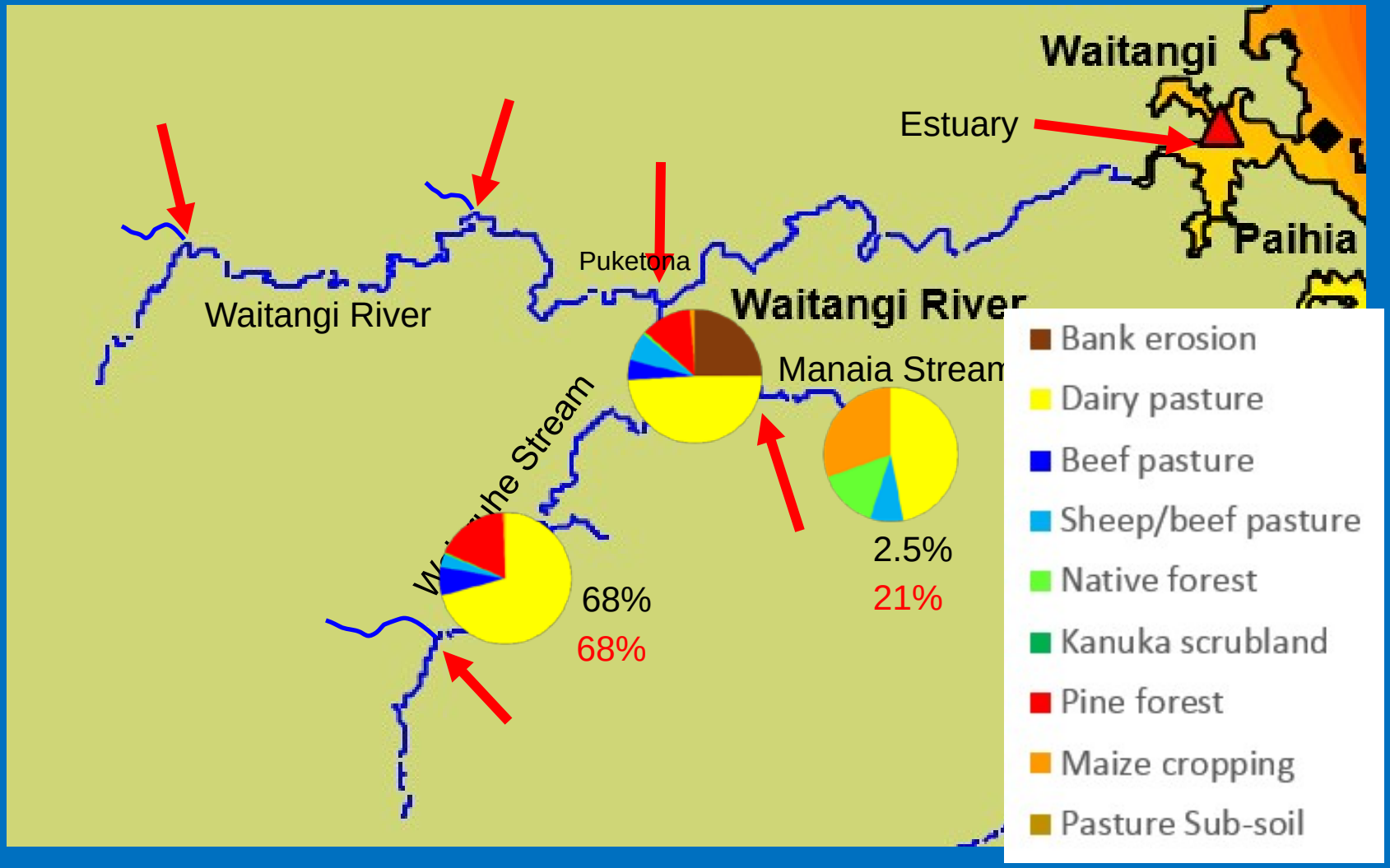

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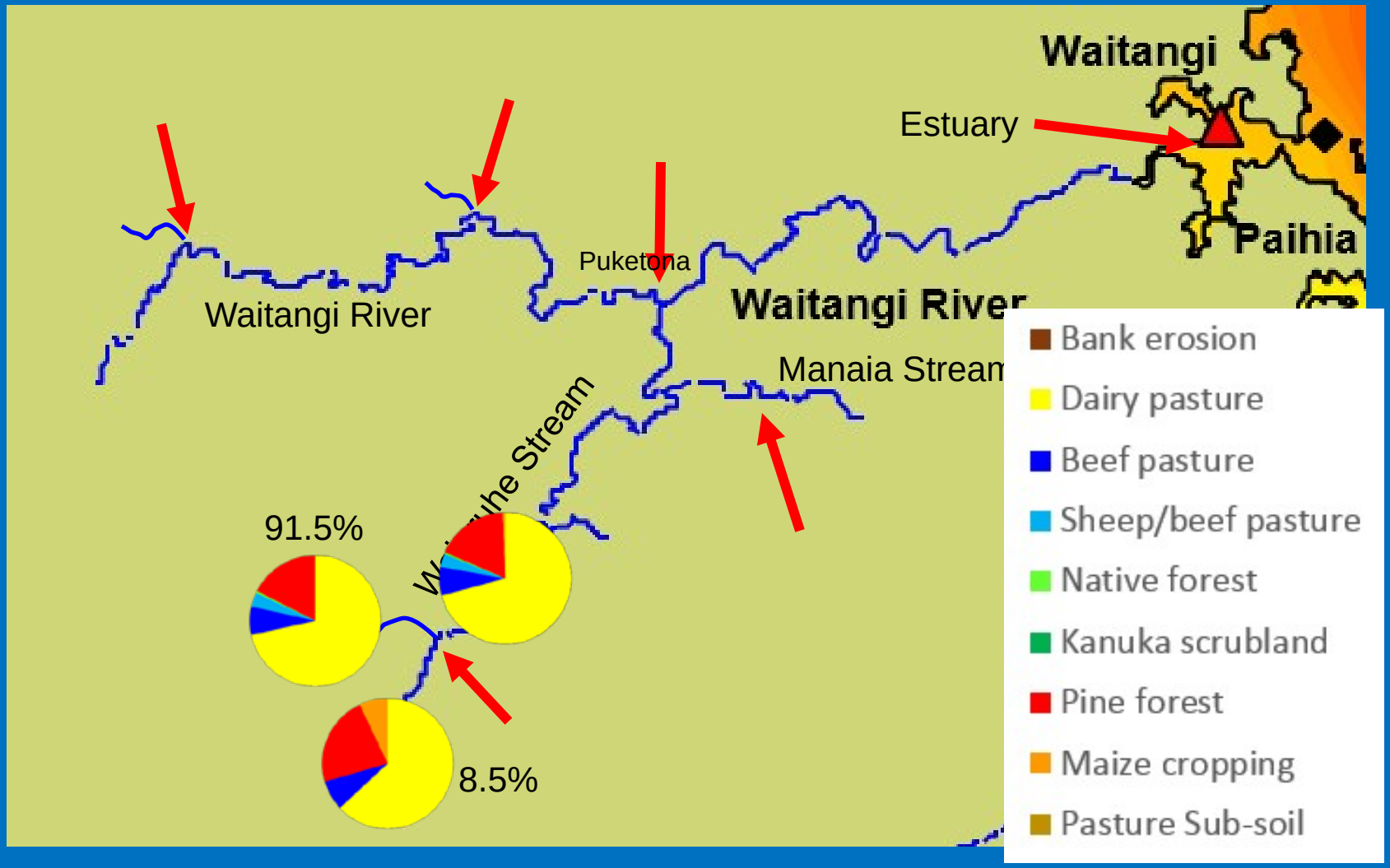

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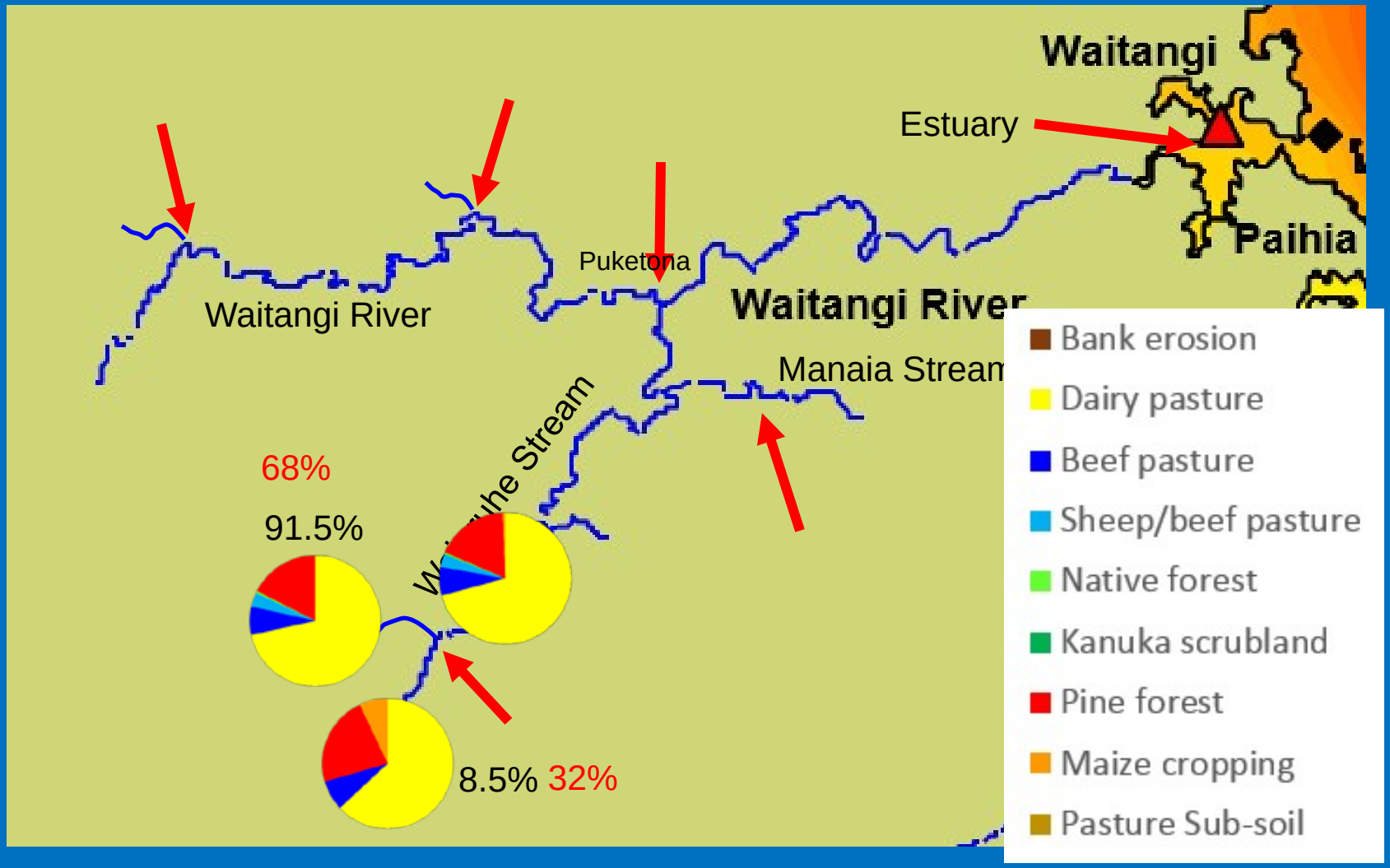

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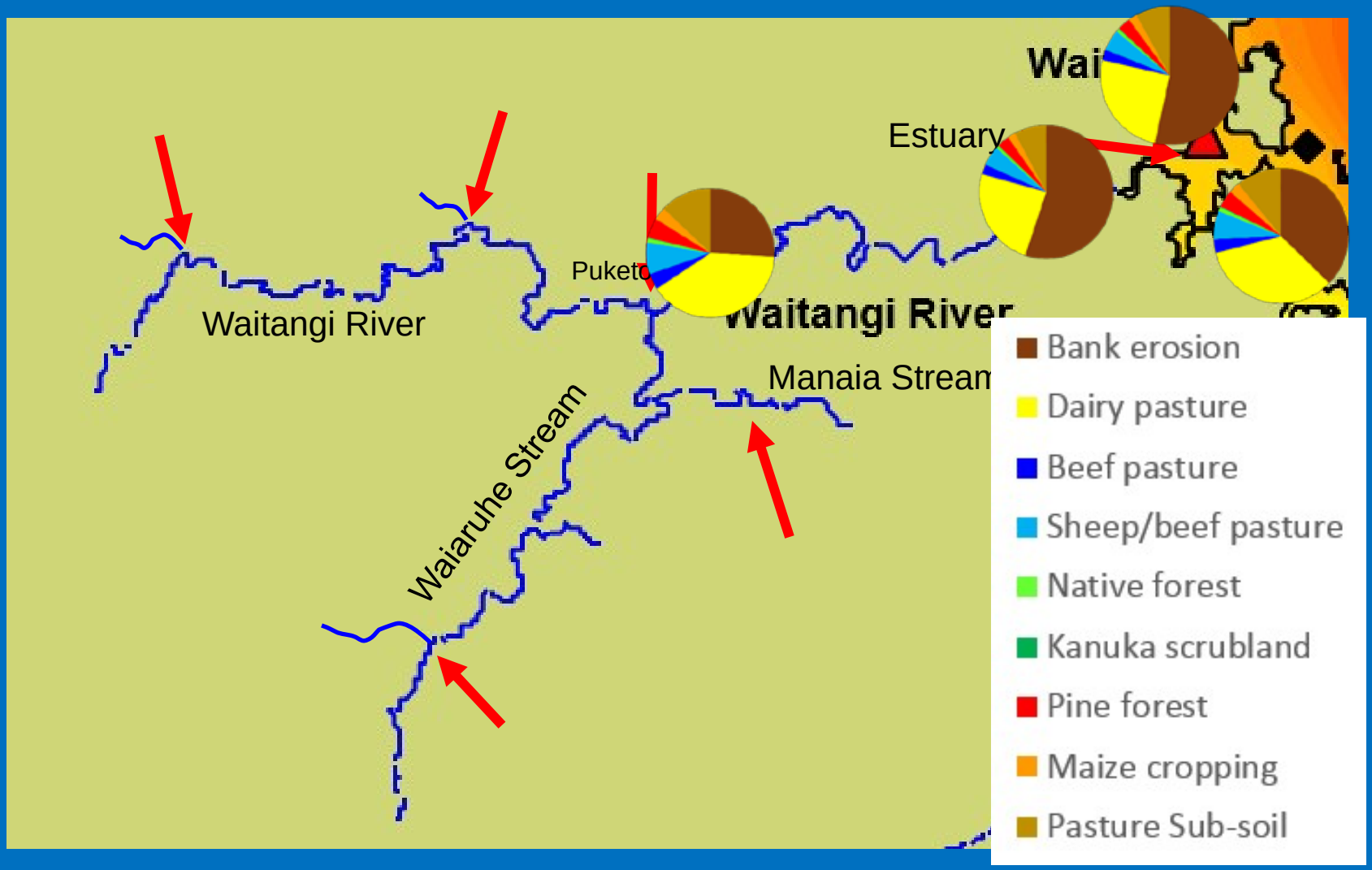

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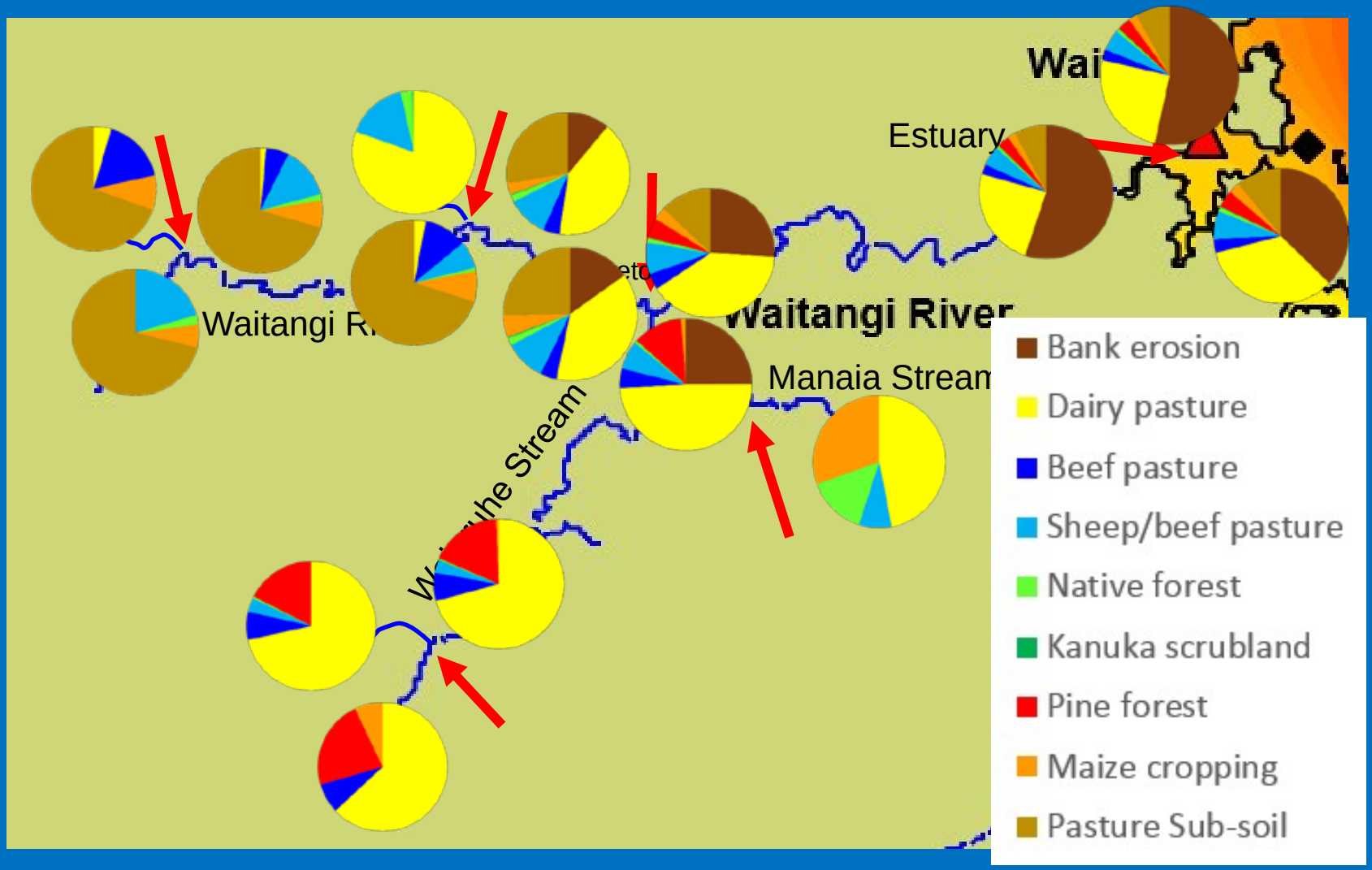

Conclusions:

Major sediment sources by land use are:		Area
- Bank erosion	45%	
- Pasture (sub-soil)	10%	
- Pasture (dairy plus beef)	35%	66%
- Pasture (sheep)	6%	
- Pine forest	4%	6%
- Native forest	<1%	14%
- Kanuka scrub	<1%	7%

Conclusions cont.:

Major sediment sources by sub-catchment are:

- Upper Waitangi River
  - Pasture (sub-soil, dairy, sheep and beef)
- Waiaruhe River
  - Pasture (dairy, beef), Pine
- Lower Waitangi River
  - Bank erosion and pasture (dairy)

Conclusions cont.:

Catchments producing more sediment than expected by land area:

Upper North Waitangi	34.5% from 6% - (earth flow)
Waipapa	50% from 16% - (dairy on volcanic)

Catchments producing less sediment than expected by land area:

Manaia	2.5% from 21% - (low gradient)
Puketotara	8.5% from 32% - (wetland)

Thank you

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