

Table S1. LIST OF WEATHER, STREAMFLOW, AND WATER QUALITY STATIONS USED IN THE CHARACTERIZATION OF THE OTUN RIVER WATERSHED.

Station No.	Description	Type	Elevation (m)	Availability (dates/percent completeness)
1	Pez Fresco	Meteorology	1875	10/1/1993–5/20/2020 / 98%
2	Playa Rica	Meteorology	1728	10/4/1993–4/30/2020 / 97%
3	Nuevo Libare	Meteorology	1625	9/1/2004–6/30/2019/ 100%
4	Matecaña Airport	Meteorology	1199	Rainfall: 1/1/1960–12/31/2019 / 98% TMAX: 3/22/1963–5/13/2020 / 29% TMIN: 3/22/1963–5/13/2020 / 50% TAVG: 3/22/1963–5/13/2020 / 83%
5	La Bohemia	Meteorology	995	10/1/1963–7/22/2019 / 89%
6	La Bananera	Hydrology	1589	1/1/1971–12/31/2013 / 98%
7	El Reten	Hydrology	188	1/1/1996–12/31/2015/ 99%
8	Otun River-El Cedral	Water quality	2150	8/30/2010–12/12/2018 / 100%
9	Barbo River-Discharge after Pezfresco	Water quality	1800	8/30/2010–12/12/2018 / 100%
10	Otun River-Reten EEPP	Water quality	1700	8/30/2010–12/12/2018 / 100%
11	El Manzano Creek-La Florida Bridge	Water quality	1686	8/30/2010–12/12/2018 / 100%
12	Otun River-La Bananera	Water quality	1555	8/30/2010–12/12/2018 / 96%
13	Otun River-Nuevo Libare Intake	Water quality	1540	8/31/2010–12/12/2018 / 100%
14	Otun River-After San José Creek	Water quality	1500	8/31/2010–12/12/2018 / 100%
15	After Otun glassworks	Water quality	1436	8/31/2010–10/8/2014 / 55%
16	El Calvario Creek, discharge	Water quality	1411	8/31/2010–12/11/2018 / 100%
17	Otun River-After Carrefour	Water quality	1400	9/1/2010–12/11/2018 / 100%
18	Dosquebradas Creek-Discharge	Water quality	1300	9/1/2010–12/11/2018 / 96%
19	Egoya Sewer Manifold Discharge	Water quality	1291	9/1/2010–12/11/2018 / 100%
20	After Egoya Mainfold Discharge	Water quality	1200	9/1/2010–10/7/2014 / 55%
21	Otun River-After Belmonte	Water quality	1200	9/1/2010–12/11/2018 / 96%
22	Otun River-After Glorita Landfill	Water quality	1000	9/1/2010–12/11/2018 / 96%
23	Otun River-Discharge	Water quality	920	9/1/2010–12/11/2018 / 96%

Streamflow: 01/01/1994-12/31/2015. Water Quality: 09/01/2010-12/12/2018.

Table S2. Rainfall data completeness for stations during the period in common (2005–2019).

Station	Years with complete data	% of complete years*	Range of consecutive years with complete data	Months with complete data (M1)**	Months missing 2 records at most (M2)***	Months missing more than 2 records (M3)	% of complete months
Pez Fresco	15	100	2005–2019	180	3	0	100
Playa Rica	15	100	2005–2019	180	3	0	100
Nuevo Libare	15	100	2005–2019	180	7	0	100
Matecaña Airport	13	80	2005–2017	177	4	3	98

*ETCCDI criterion for extreme [57]. ** PRISM group criterion [58] same; ***These values are included in the months with complete data (M1).

Table S3. Statistical properties and essential characteristics of seasonal rainfall for ORW stations (01/01/2005–12/31/2019).

Station	Season	Min (mm)	Max (mm)	Mean (mm)	StDev (mm)	Median (mm)	IQR (mm)	1-Day Max (mm)	# of Wet (Days)	# Days $\geq$ 95 th pct	# Days $\geq$ 99 th pct
Pez Fresco (PF)	Dry	70.7	521.6	214.1	125.2	176.2	66.3	80.0	382	8	2
	Wet1	997.9	2103.8	1548.6	280.8	1605.8	267.1	102.1	1674	80	13
	Wet2	873.4	1727.8	1263.7	213.1	1197.8	274.6	115.7	1201	71	16
Playa Rica (PR)	Dry	66.6	553.5	254.6	135.3	217.8	87.1	74.3	409	13	2
	Wet1	1021.2	1948.0	1575.2	265.6	1656.8	393.4	123.0	1727	93	18
	Wet2	930.4	1869.9	1284.5	236.2	1204.3	190.6	133.2	1222	81	20
Nuevo Libare (NL)	Dry	105.8	666.3	329.1	167.2	277.2	179.0	109.6	451	14	4
	Wet1	883.8	1931.3	1509.5	278.9	1553.9	406.4	100.2	1639	78	14
	Wet2	963.8	1694.1	1303.7	227.2	1323.1	248.8	104.2	1189	73	16
Matecaña Airport (MA)	Dry	147.8	568.0	294.1	109.0	293.7	129.7	75.8	365	11	2
	Wet1	766.1	1849.5	1274.2	278.2	1316.9	165.9	83.4	1210	75	22
	Wet2	664.8	1460.1	1036.3	216.3	1030.4	213.2	104.7	917	63	13

95th and 99th thresholds: NL: 47.4 mm, 69.3 mm; PF: 44.3 mm, 72.7 mm; PR: 42.9 mm, 65.4; MA: 42.7 mm, 66.7 mm.

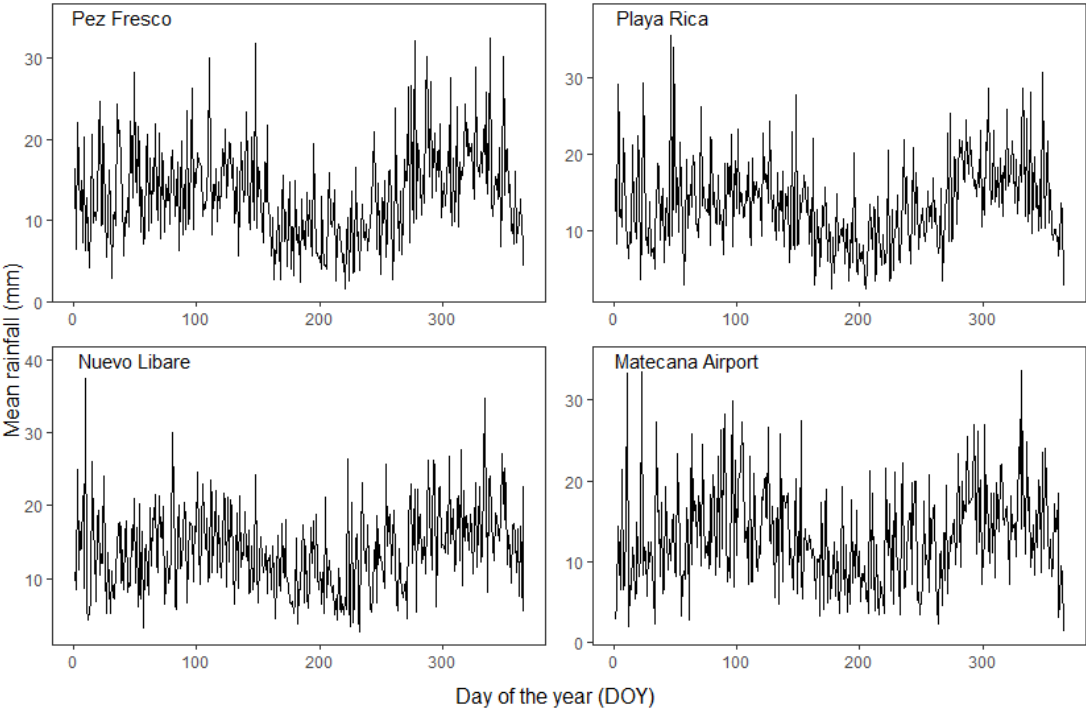


Figure S1. Mean rainfall corresponding to each day of the year (DOY) for the ORW stations (2005-2018).

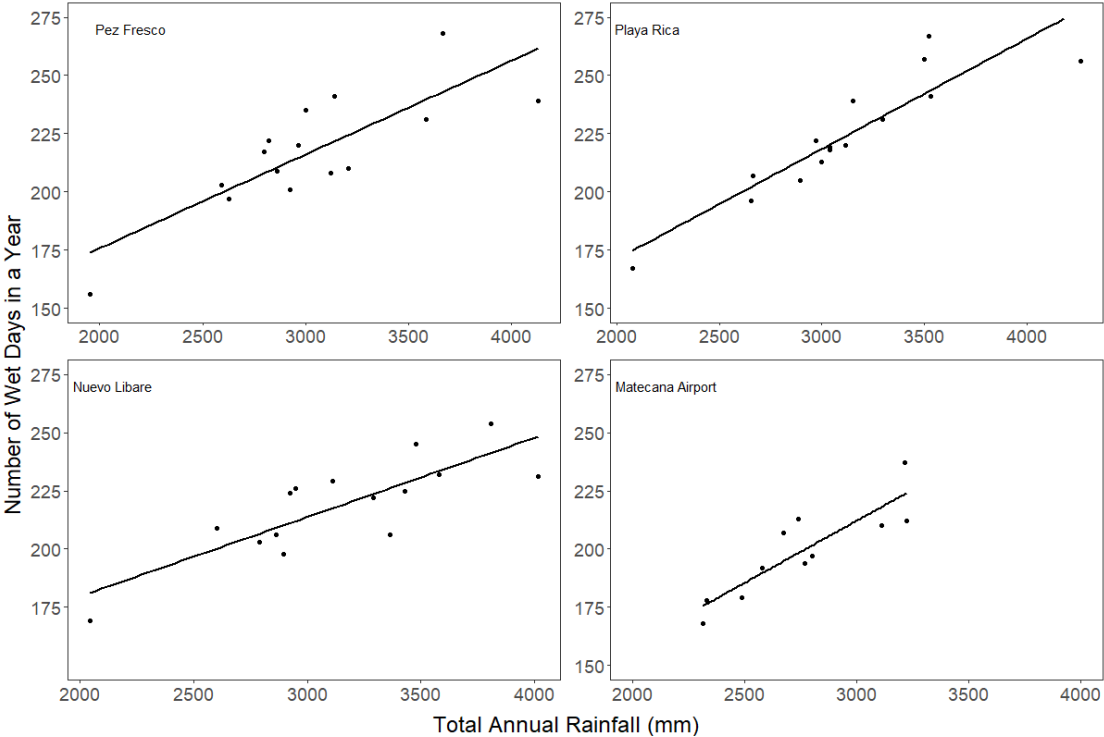


Figure S2. Relationship between number of wet days and total annual rainfall for weather stations in the ORW (2005-2019).

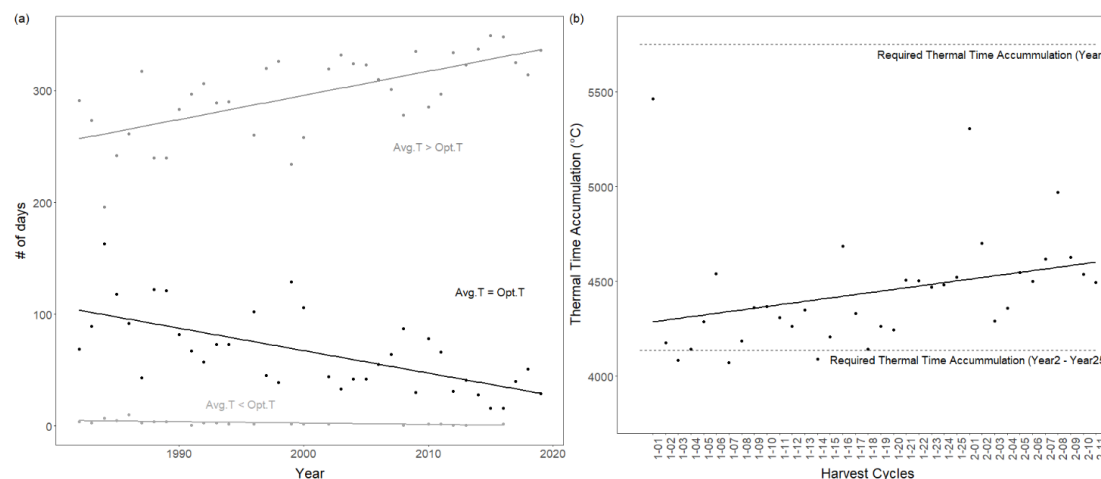


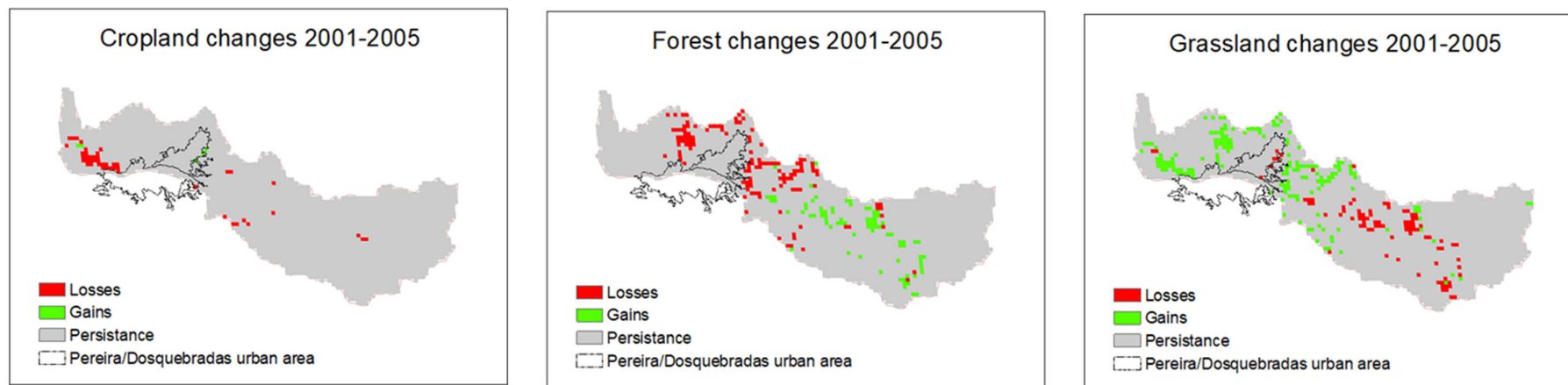
Figure S3. (a) Number of days with daily average temperatures above, equal, and below coffee's optimal growth temperature (19 °C–21 °C) based on data from Matecaña Airport. (b) Thermal time accumulation for harvest cycles from 1982 to 2019 based on data from Matecaña Airport. Harvest cycles 1-01 to 1-25 corresponded to the life cycle for the first coffee shrub and harvest cycles 2-01 to 2-11 corresponded to the life cycle for the second coffee shrub.

Table S4. Gains, losses, net changes, and persistence of land uses in the Otun River Watershed.

	Period				
	01–05	05–09	09–13	13–17	01–17
Gains					
Forests	3.6%	4.4%	2.0%	2.0%	6.8%
Grasslands	7.4%	1.7%	2.9%	2.9%	7.3%
Urban	0.1%	0.1%	0.0%	0.0%	0.3%
Croplands	0.2%	2.0%	1.0%	1.0%	0.9%
Other	0.6%	0.1%	0.2%	0.2%	0.4%
Losses					
Forests	5.6%	1.8%	2.4%	3.1%	5.6%
Grasslands	3.9%	5.9%	2.6%	5.1%	7.9%
Urban	0.0%	0.0%	0.0%	0.0%	0.0%

Croplands	2.0%	0.0%	0.8%	1.6%	1.7%
Other	0.3%	0.6%	0.3%	0.4%	0.1%
Net Change					
Forests	−2.0%	2.5%	−0.4%	1.9%	1.2%
Grasslands	3.5%	−4.2%	0.4%	−0.8%	−0.6%
Urban	0.1%	0.1%	0.0%	0.0%	0.3%
Croplands	−1.8%	2.0%	0.1%	−1.1%	−0.8%
Other	0.3%	−0.5%	−0.1%	0.0%	−0.1%
Normalized Persistence					
Forests	83.4%	94.1%	92.8%	90.8%	83.3%
Grasslands	93.1%	90.3%	95.2%	91.0%	86.0%
Urban	100.0%	100.0%	100.0%	100.0%	100.0%
Croplands	51.6%	100.0%	80.6%	64.4%	58.9%
Other	46.2%	26.3%	50.0%	16.7%	7.7%

(a)



(b)

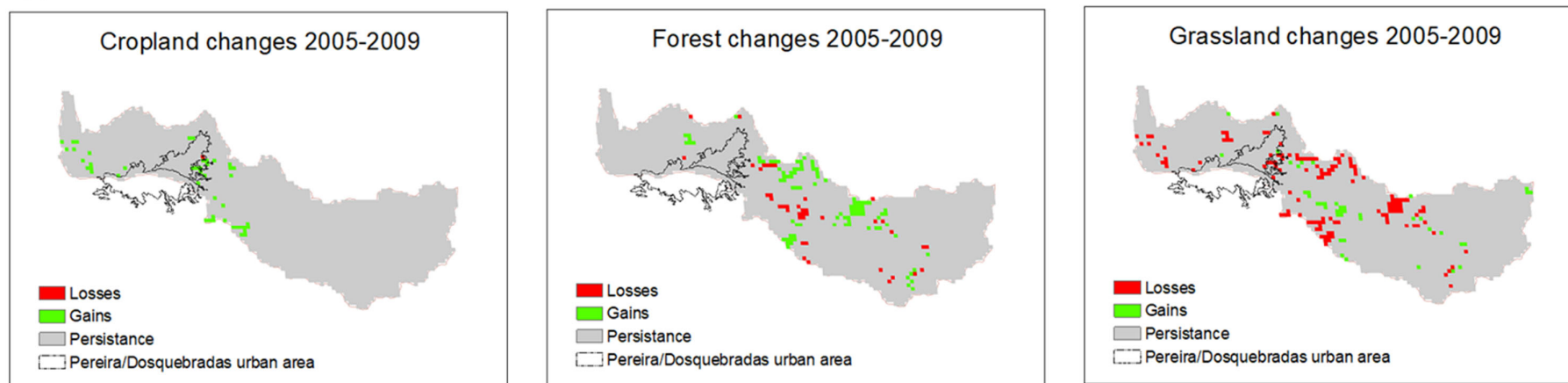
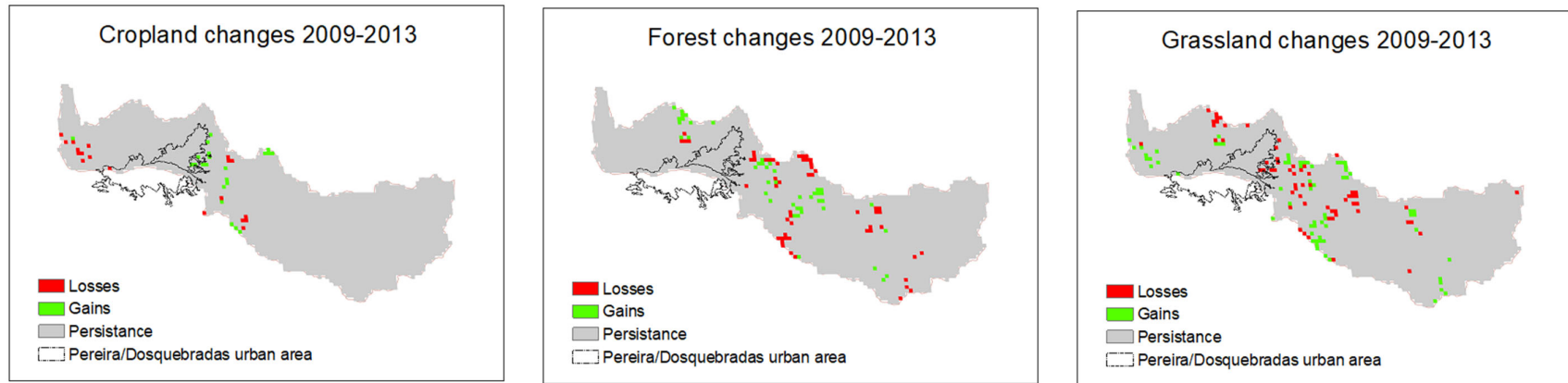


Figure S4. (a) Change in croplands, forests, and grasslands in the Otun River Watershed from 2001 to 2005; (b) Change in croplands, forests, and grasslands in the Otun River Watershed from 2005 to 2009.

(a)



(b)

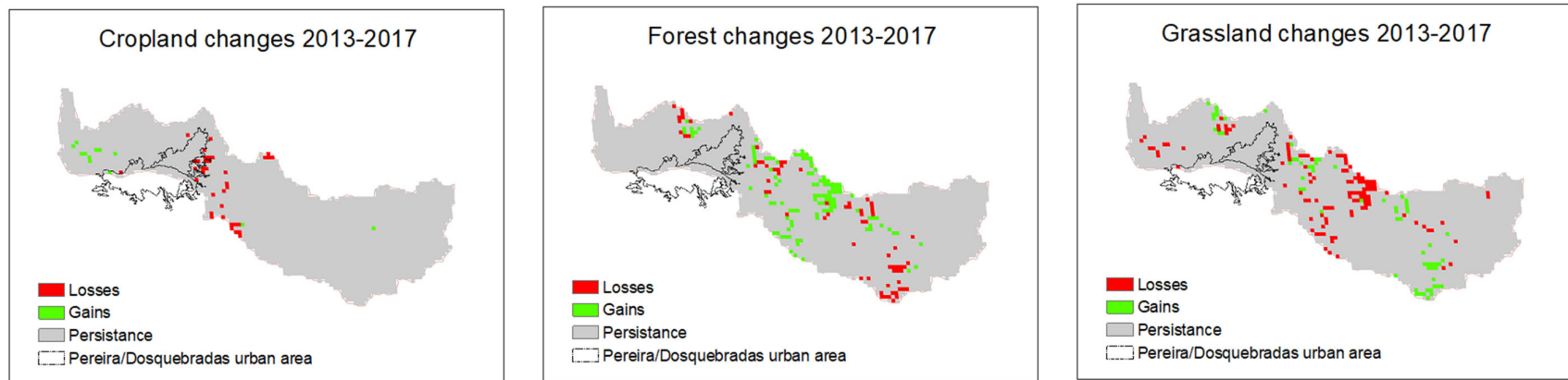


Figure S5. (a) Change in croplands, forests, and grasslands in the Otun River Watershed from 2009 to 2013; (b) Change in croplands, forests, and grasslands in the Otun River Watershed from 2013 to 2017.

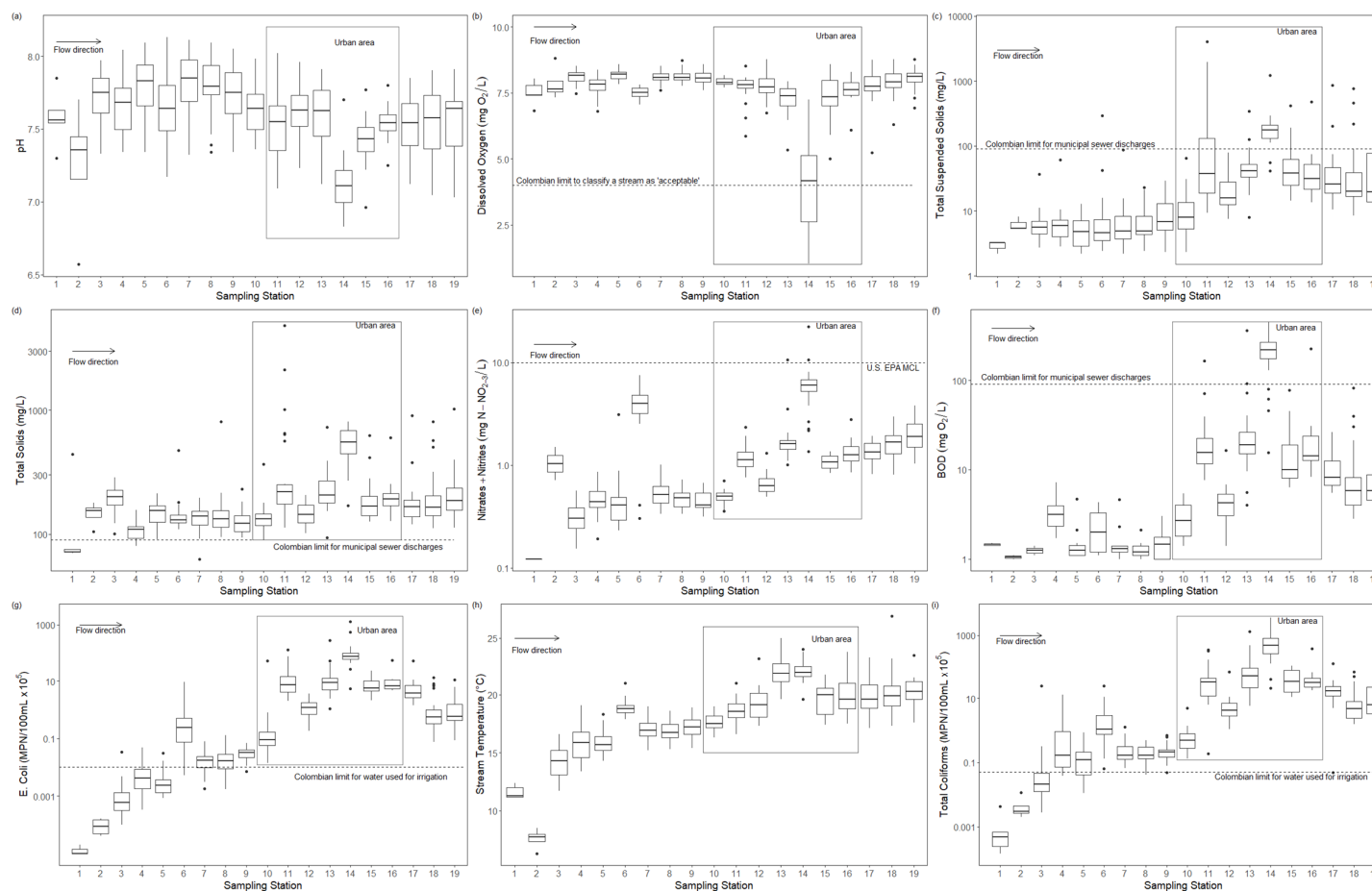


Figure S6. Water quality results at different sampling stations across the ORW. Sampling station (SS) 1: Otun River (OR)-Otun Lake, SS2: OR after El Mosquito Lake, SS3: OR-El Cedral, SS4: Barbo River-Outlet, SS5: OR-El Reten EEP, SS6: El Manzano Creek-La Florida bridge, SS7: OR-La Bananera, SS8: OR-Nuevo Libare Intake, SS9: OR-after San Jose Creek, SS10: OR-After Otun glassworks, SS11: El Calvario Creek outlet, SS12: OR-after Carrefour, SS13: Dosquebradas Creek-outlet, SS14: OR-Egoya sewer outlet, SS15: OR-After Egoya sewer discharge, SS16: OR-La Marsella bridge, SS17: OR-after Belmonte, SS18: OR-After Glorita landfill, SS19: OR outlet.

Table S5. Non-parametric trends for selected water quality parameters at ORW.

Parameter	# of observations	Tau	p-value
pH	252	−0.285	<0.0001
DO	250	−T0.178	<0.0001
TSS	272	0.477	<0.0001
TS	282	0.120	0.002
NO ₂₋₃	213	0.643	<0.0001
BOD	178	0.418	<0.0001
E.Coli	282	0.626	<0.0001
Total coliforms	282	0.590	<0.0001

Table S1. Seasonal Mann-Kendall test results for all water quality stations located in the ORW.

Parameter	Season								
	Wet1			Dry			Wet2		
	# of observations	Tau	p-value	# of observations	Tau	p-value	# of observations	Tau	p-value
pH	64	−0.089	0.265	85	0.116	0.099	103	0.286	<0.0001
DO	62	−0.054	0.543	85	−0.048	0.519	103	0.300	<0.0001
TSS	67	−0.018	0.833	93	−0.065	0.361	112	−0.047	0.464
TS	74	0.048	0.550	95	0.152	0.030	113	0.023	0.715
NO ₂₋₃	58	0.123	0.175	77	0.137	0.079	78	−0.035	0.651
BOD	50	0.076	0.441	59	0.114	0.204	69	−0.086	0.300
E.Coli	74	−0.021	0.794	95	−0.032	0.653	113	−0.012	0.847
Total coliforms	74	−0.037	0.644	95	0.002	0.979	113	0.041	0.524

Table S7. Seasonal Mann-Kendall test results for water quality stations located in the ORW's urban area.

Parameter	Season		
	Wet1	Dry	Wet2

	# of observations	Tau	p- value	# of observations	Tau	p- value	# of observations	Tau	p- value
pH	12	−0.243	0.250	16	0.184	0.306	20	0.427	0.006
DO	11	−0.0037	0.938	16	−0.333	0.079	20	0.185	0.270
TSS	12	0.030	0.945	18	−0.176	0.325	22	−0.083	0.611
TS	14	0.099	0.661	18	0.359	0.041	22	0.043	0.800
NO₂₋₃	12	0.364	0.115	18	0.007	1.000	18	0.059	0.762
BOD	14	0.033	0.913	17	0.265	0.149	21	0.248	0.124
E.Coli	14	0.187	0.381	18	0.176	0.325	22	0.009145	0.977
Total coliforms	14	0.022	0.956	18	0.190	0.289	22	0.056	0.735

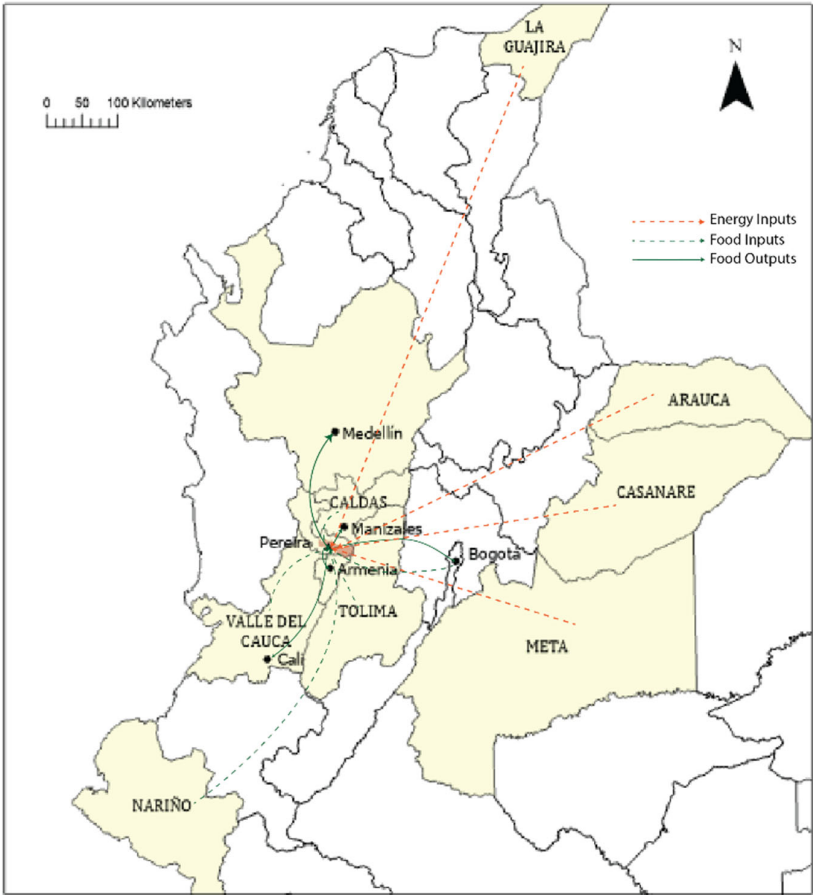


Figure S7. Food and energy flows for Pereira.