



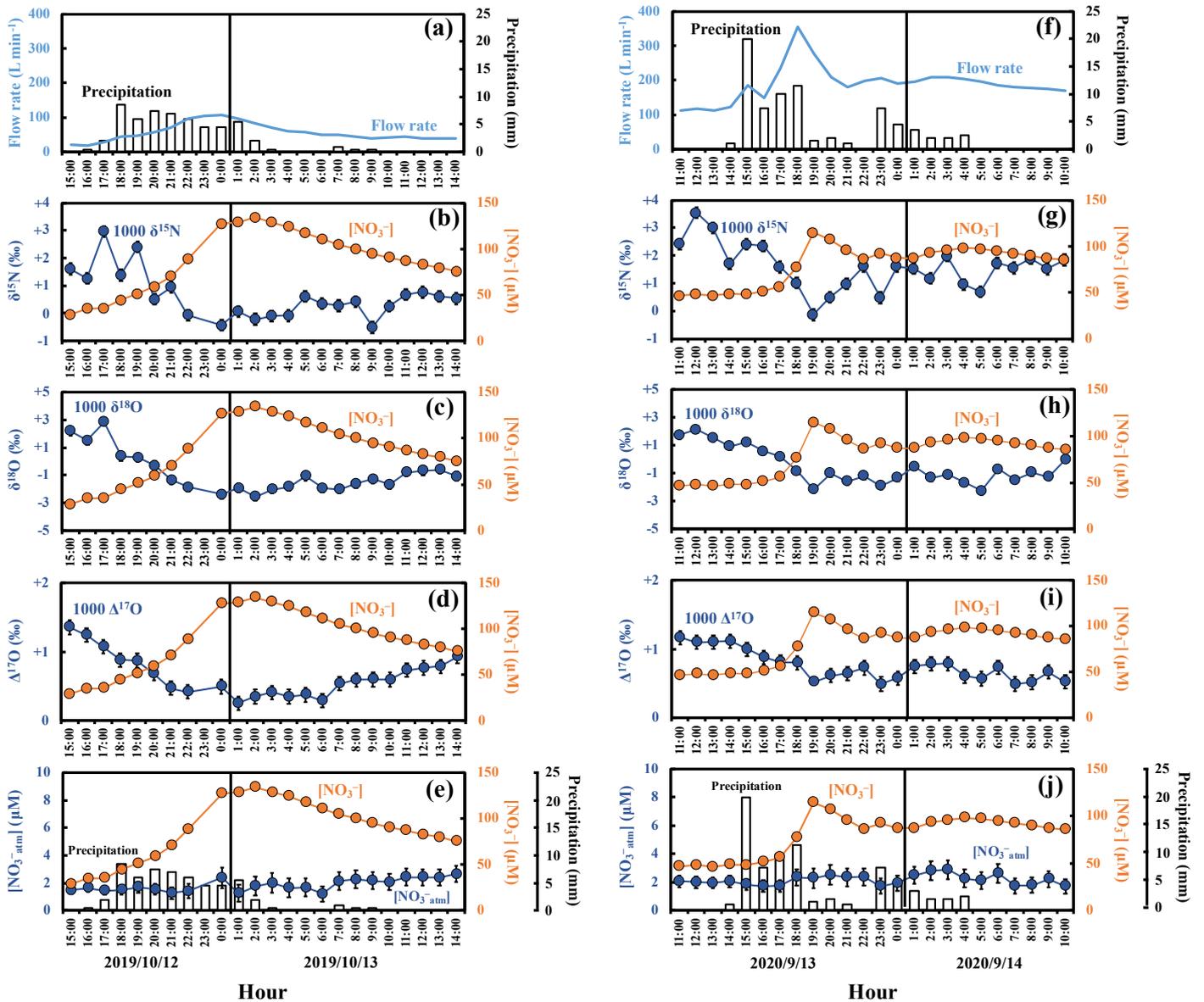
*Supplement of*

## **Tracing the source of nitrate in a forested stream showing elevated concentrations during storm events**

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**Figure S1.** Temporal variations in the amount of precipitation (bar chart) and flow rates of the stream water (blue line) during storm event II (a) and III (f), together with those in the concentrations of nitrate (orange circles) (a-j) and the values of  $\delta^{15}\text{N}$  (b and g),  $\delta^{18}\text{O}$  (c and h), and  $\Delta^{17}\text{O}$  (d and i) of nitrate, and  $[\text{NO}_3^-_{\text{atm}}]$  (e and j) in the stream water (blue circles). The error bars smaller than the sizes of the symbols are not presented.

**Table S1.** Flow rates, precipitations\*, concentrations, and isotopic compositions of stream nitrate during routine observation.

	Flow rate L/min	Precipitation mm/day	NO <sub>3</sub> <sup>-</sup> μM	δ <sup>15</sup> N(NO <sub>3</sub> <sup>-</sup> ) /10 <sup>3</sup>	δ <sup>18</sup> O(NO <sub>3</sub> <sup>-</sup> ) /10 <sup>3</sup>	Δ <sup>17</sup> O(NO <sub>3</sub> <sup>-</sup> ) /10 <sup>3</sup>
2017/5/31	61.4	0.0	39.9	+2.96	+0.55	+1.59
2017/6/30	56.0	1.0	38.2	+4.54	+3.25	+1.80
2017/7/31	83.9	0.0	47.1	+1.79	+1.99	+2.11
2017/8/31	114.2	4.0	58.4	+5.43	+2.11	+1.48
2017/9/29	89.7	0.5	47.1	+0.72	+0.02	+1.21
2017/10/31	86.8	12.0	56.6	+2.45	+0.79	+1.10
2017/11/30	136.7	0.0	74.0	+1.98	+0.41	+0.45
2017/12/28	180.9	3.0	59.5	+2.51	+1.70	+1.34
2018/2/5	161.8	9.0	43.8	–	–	–
2018/2/28	952.2	5.0	45.4	+2.87	+2.59	+1.14
2018/3/30	140.0	0.5	48.2	+0.06	+1.04	+1.45
2018/4/27	126.9	0.0	43.5	+1.19	+1.10	+1.20
2018/5/31	104.8	0.0	42.3	+1.23	+0.88	+1.38
2018/6/29	83.9	1.5	38.7	+1.75	+1.32	+1.44
2018/7/30	53.4	0.0	35.7	+5.91	+4.14	+1.49
2018/8/31	216.9	48.0	129.3	+1.76	-1.90	+0.36
2018/9/28	75.2	6.5	51.3	+3.19	+0.94	+0.90
2018/10/31	86.8	7.0	62.6	+1.62	-0.31	+0.73
2018/11/30	72.4	0.0	54.3	+1.17	+0.76	+0.91
2018/12/28	111.0	22.0	70.0	+2.17	+0.61	+1.17
2019/1/31	117.3	5.5	62.4	+1.27	+7.71	+2.73
2019/2/28	92.7	0.0	56.1	+2.89	+2.53	+1.50
2019/3/29	72.4	0.0	48.3	+1.56	+2.54	+1.62
2019/4/25	98.7	18.0	43.1	+1.01	+1.47	+1.35
2019/5/31	71.0	0.0	40.4	+0.72	+0.91	+1.13
2019/6/28	73.2	32.5	41.1	+1.11	+0.52	+1.10
2019/7/31	61.6	0.0	39.5	+1.55	+0.66	+1.06
2019/8/30	66.0	13.0	44.9	+2.07	-0.13	+0.91
2019/9/30	28.0	0.0	37.9	+1.65	+1.56	+1.36
2019/10/31	32.6	0.0	50.4	+1.04	+0.19	+0.92
2019/11/29	45.0	4.5	67.1	+1.08	-0.31	+0.71
2019/12/27	62.9	15.5	79.0	+0.65	-0.39	+0.45
2020/1/31	61.8	17.0	56.5	+0.73	-0.20	+0.71
2020/2/28	65.5	3.5	69.5	+0.76	+0.32	+0.98
2020/3/31	71.1	0.0	62.6	+0.74	+0.14	+0.62

–No sample

\* Total amount of precipitation during 24 hours prior to sampling.

**Table S2.** Flow rates, precipitations, concentrations, and isotopic compositions of stream nitrate during storm event I (2019/8/22).

	Flow rate L/min	Precipitation mm/h	NO <sub>3</sub> <sup>-</sup> μM	δ <sup>15</sup> N(NO <sub>3</sub> <sup>-</sup> ) /10 <sup>3</sup>	δ <sup>18</sup> O(NO <sub>3</sub> <sup>-</sup> ) /10 <sup>3</sup>	Δ <sup>17</sup> O(NO <sub>3</sub> <sup>-</sup> ) /10 <sup>3</sup>
16:00	64.1	0	24.7	+2.32	+2.17	+1.33
17:00	64.1	0	29.2	+1.79	+2.82	+1.25
18:00	64.1	0	34.5	+1.35	+2.14	+1.25
19:00	64.1	0	33.7	+2.00	+2.40	+1.60
20:00	64.1	0	32.5	+2.52	+1.63	+1.41
21:00	64.1	0	32.7	+2.33	+2.47	+1.07
22:00	61.4	0	32.5	+2.33	+2.47	+0.93
23:00	61.4	0	32.5	+2.27	+2.65	+1.25
0:00	58.7	0	32.7	+2.08	+2.26	+1.21
1:00	61.4	0	32.3	+2.28	+3.11	+1.52
2:00	64.1	1	31.9	+1.92	+1.99	+1.60
3:00	72.4	3	33.7	+1.24	+1.24	+1.17
4:00	83.9	11	37.2	+1.42	+0.16	+1.42
5:00	198.7	12	75.8	+0.21	-2.02	+0.64
6:00	281.4	20	122.6	+0.00	-3.34	+0.31
7:00	209.6	2.5	110.6	-0.13	-3.34	+0.32
8:00	153.3	0.5	88.9	+0.91	-2.34	+0.50
9:00	120.5	0.5	74.4	+0.91	-2.04	+0.69
10:00	104.8	1	66.9	+1.34	-1.19	+0.52
11:00	228.0	10	97.9	+0.29	-1.30	+0.74
12:00	167.0	0	97.3	+0.64	-1.91	+0.51
13:00	133.4	0	86.7	+0.79	-2.18	+0.47
14:00	111.0	0	76.6	+0.86	-1.81	+0.51
15:00	92.7	0	69.3	+1.36	-1.42	+0.52

**Table S3.** Flow rates, precipitations, concentrations, and isotopic compositions of stream nitrate during storm event II (2019/10/12).

	Flow rate L/min	Precipitation mm/h	NO <sub>3</sub> <sup>-</sup> μM	δ <sup>15</sup> N(NO <sub>3</sub> <sup>-</sup> ) /10 <sup>3</sup>	δ <sup>18</sup> O(NO <sub>3</sub> <sup>-</sup> ) /10 <sup>3</sup>	Δ <sup>17</sup> O(NO <sub>3</sub> <sup>-</sup> ) /10 <sup>3</sup>
15:00	22.4	0	28.7	+1.61	+2.18	+1.35
16:00	18.3	0.5	34.9	+1.26	+1.51	+1.24
17:00	29.0	2	35.4	+2.96	+2.85	+1.07
18:00	45.7	8.5	44.4	+1.38	+0.34	+0.88
19:00	48.2	6	51.2	+2.40	+0.25	+0.87
20:00	58.7	7.5	59.0	+0.51	-0.31	+0.68
21:00	69.6	7	70.5	+0.95	-1.35	+0.47
22:00	95.7	6	88.6	-0.06	-1.88	+0.42
23:00	104.8	4.5	-	-	-	-
0:00	107.9	4.5	127.2	-0.43	-2.42	+0.49
1:00	95.7	5.5	128.9	+0.07	-1.93	+0.26
2:00	83.9	2	134.1	-0.22	-2.56	+0.35
3:00	69.6	0.5	129.0	-0.10	-2.05	+0.41
4:00	61.4	0	124.1	-0.08	-1.85	+0.35
5:00	58.7	0	117.4	+0.61	-1.08	+0.38
6:00	50.8	0	110.9	+0.35	-1.96	+0.29
7:00	50.8	1	104.7	+0.28	-2.05	+0.54
8:00	45.7	0.5	100.1	+0.43	-1.66	+0.59
9:00	40.7	0.5	94.9	-0.50	-1.30	+0.60
10:00	43.2	0	90.7	+0.25	-1.68	+0.60
11:00	45.7	0	86.9	+0.67	-0.80	+0.73
12:00	40.7	0	82.8	+0.77	-0.69	+0.76
13:00	40.7	0	79.8	+0.62	-0.62	+0.79
14:00	38.3	0	75.4	+0.54	-1.09	+0.93

- No sample

**Table S4.** Flow rates, precipitations, concentrations, and isotopic compositions of stream nitrate during storm event III (2020/9/13).

	Flow rate L/min	Precipitation mm/h	NO <sub>3</sub> <sup>-</sup> μM	δ <sup>15</sup> N(NO <sub>3</sub> <sup>-</sup> ) /10 <sup>3</sup>	δ <sup>18</sup> O(NO <sub>3</sub> <sup>-</sup> ) /10 <sup>3</sup>	Δ <sup>17</sup> O(NO <sub>3</sub> <sup>-</sup> ) /10 <sup>3</sup>
11:00	111.0	0	46.6	+2.42	+1.74	+1.17
12:00	117.3	0	48.0	+3.54	+2.12	+1.10
13:00	111.0	0	46.3	+3.00	+1.53	+1.10
14:00	123.7	1	48.4	+1.70	+0.87	+1.12
15:00	184.4	20	48.1	+2.40	+1.13	+1.00
16:00	150.0	7.5	51.5	+2.34	+0.61	+0.88
17:00	235.4	10	56.2	+1.59	+0.18	+0.81
18:00	353.9	11.5	77.1	+1.01	-0.88	+0.80
19:00	277.5	1.5	114.5	-0.13	-2.19	+0.52
20:00	209.6	2	107.3	+0.49	-0.97	+0.61
21:00	180.9	1	95.7	+0.98	-1.57	+0.65
22:00	198.7	0	86.1	+1.61	-1.21	+0.73
23:00	205.9	7.5	92.3	+0.48	-1.88	+0.49
0:00	191.5	4.5	87.3	+1.60	-1.32	+0.58
1:00	195.1	3.5	87.1	+1.52	-0.53	+0.75
2:00	209.6	2	93.4	+1.18	-1.33	+0.78
3:00	209.6	2	95.9	+1.99	-1.10	+0.79
4:00	202.3	2.5	98.4	+0.96	-1.66	+0.60
5:00	195.1	0	97.1	+0.69	-2.25	+0.57
6:00	184.4	0	94.8	+1.72	-0.71	+0.73
7:00	180.9	0	92.4	+1.55	-1.46	+0.49
8:00	177.4	0	89.9	+1.89	-0.92	+0.52
9:00	173.9	0	87.2	+1.52	-1.24	+0.66
10:00	170.4	0	85.7	+1.84	+0.02	+0.52