Supplemental Materials for

Fire transforms effects of terrestrial subsidies on aquatic ecosystem structure and function

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Supporting Text

Supplemental Results

Dissolved oxygen percent

Dissolved oxygen (DO as % O_2) measurements showed consistent patterns among replicate dawn measurements (separated by 24 h) in each time point (Fig. S6), although % O_2 showed considerable change over time. At Day-10, dawn and dusk % O_2 was consistently < 50 % in tanks receiving more than 100 g of plant material, with treatments > 200 g plant material showing hypoxic conditions (< 10 % O_2). Significant non-linear relationships between % O_2 and plant biomass were observed in all time points, with treatment-specific intercepts for a global smoother at Day-10 and significant non-linear relationships that varied by treatment for dawn-and-dusk measurements at Days-31 and 59 (*SI Appendix*, Tables S5 and S6). Measurements on Days-31 and 59 also showed significantly higher % O_2 in mid-range burned tanks (100-200g) compared to unburned, however, % O_2 was consistently lower in burned treatments at 400 g compared to unburned tanks (*SI Appendix*, Fig. S7). By Day-89, treatment effects were minimal although % O_2 remained higher in tanks receiving less plant materials (*SI Appendix*, Fig. S6).

Isotope labeling

Nitrogen isotope labeling (^{15}N) substantially increased the $\delta^{15}N$ isotope values of pooled burned-and-unburned sage leaf materials (mean ± SD; 296 ± 53 ‰) relative to willow (13 ± 0.3 ‰) (p<0.001) (Fig. S9, Table S9A). Burning treatment did not affect leaf $\delta^{15}N$ values for sage (p=0.423) or willow (p=0.485). C:N values were higher in burned relative to unburned sage (p=0.001), driven by higher C:N values (~ 70) in sage subjected to longer fire treatment (i.e., very-burned sage), but equivalent between burned and

unburned willow (p=0.061) (*SI Appendix*, Fig. S9 and Table S9A). $\delta^{15}N$ values did not differ between burned and unburned sage (p=0.423) or willow (p=0.485). Using pooled burned and unburned leaves, sage had C:N values slightly higher than willow (mean 49 and 47) (p=0.014) (*SI Appendix*, Fig. S9B). Plankton $\delta^{15}N$ values were slightly lower than those in the plankton (11 vs. 13 ‰) (p=0.001), and plankton C:N was significantly lower than willow (mean 5.8) (p<0.001) (*SI Appendix*, Fig. S9B and Table S9A).

Plankton $\delta^{15}N$ was used in isotope mixing models to determine the percent of sage-^{15}N incorporated into plankton biomass. Raw $\delta^{15}N$ values are reported in (*SI Appendix*, Fig. S9C, D). GAM models fit to raw $\delta^{15}N$ values can be found in (*SI Appendix*, Table S11).

The positive relationship between plankton nitrogen and carbon concentrations was similar among burned and unburned treatments (*SI Appendix*, Fig. S11) that did not differ across time or among plankton size fractions. Plankton C:N ratios showed significant nonlinearity across the plant-biomass gradient at Day-10 and Day-31 (p≤0.038) (*SI Appendix*, Table S11), with burned treatment plankton C:N being lower in mid-range tanks (100-150 g) at Day-10 and higher in high plat-biomass treatments (400 g) at Day-10 and Day-31 (*SI Appendix*, Fig. S12).

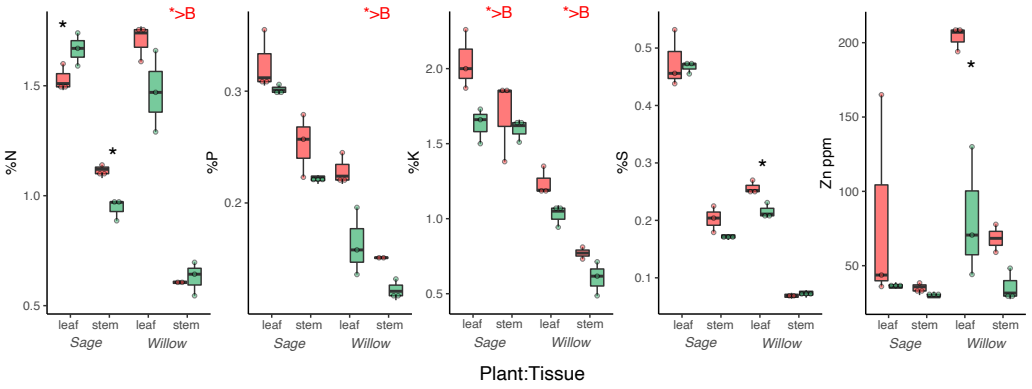

Figure S1. Elemental analysis of burned and unburned plant material (leaves and stem) from sage and willow prior to being added to experimental treatments. Significant post-hoc comparisons (p<0.05) of burned effects within a Plant:Tissue type are shown with *black asterisks*. *Red asterisks* indicate significant overall treatment effects and the direction of these effects for either sage or willow in the absence of interactions. Box plots depict the median (bold center line), first and third quartiles (lower and upper bounds), whiskers (1.5x the distance between first and third quartiles).

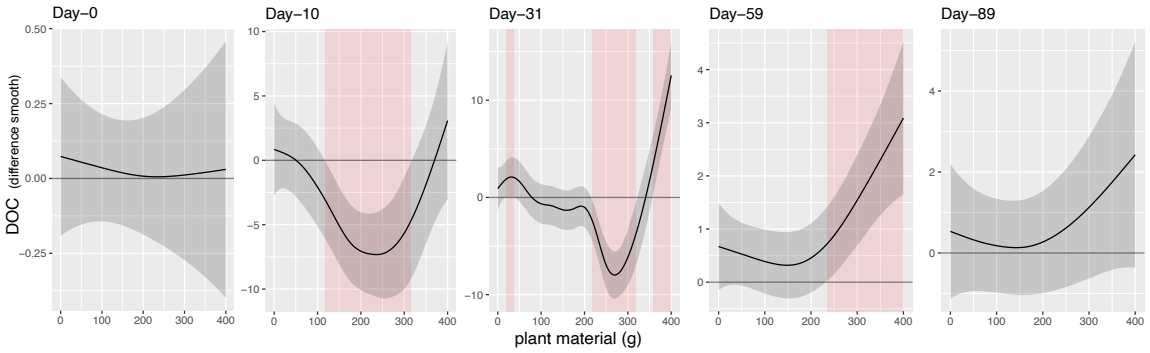

Figure S2. Model effects from GAMs with differences between smoothers for DOC concentration across time in treatments receiving burned and unburned plant material. Shaded regions are the confidence interval for 'the difference smooth,' which is the difference between burned and unburned treatment smoothers. Significant differences between treatment-level smoothers are noted in regions that do not include zero ± model confidence intervals and are shaded in pink.

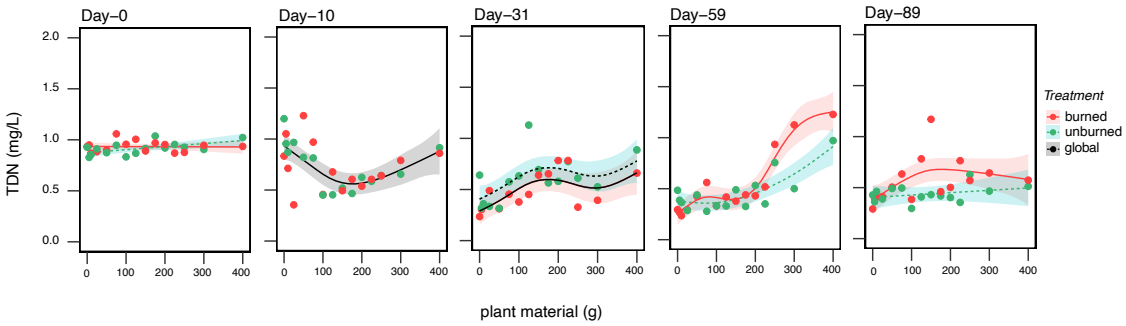

Figure S3. Total dissolved nitrogen (TDN) concentration across time in treatments receiving burned and unburned plant material. Lines represent best-fit generalized additive models (GAMs) with treatment-level 95% confidence intervals. Black lines with gray confidence intervals indicate global smoothers across all data points; solid (*burned*) and dotted (*unburned*) black lines together represent treatment-level intercepts with global smoothers; colored lines indicate factor-smooths that vary between treatments.

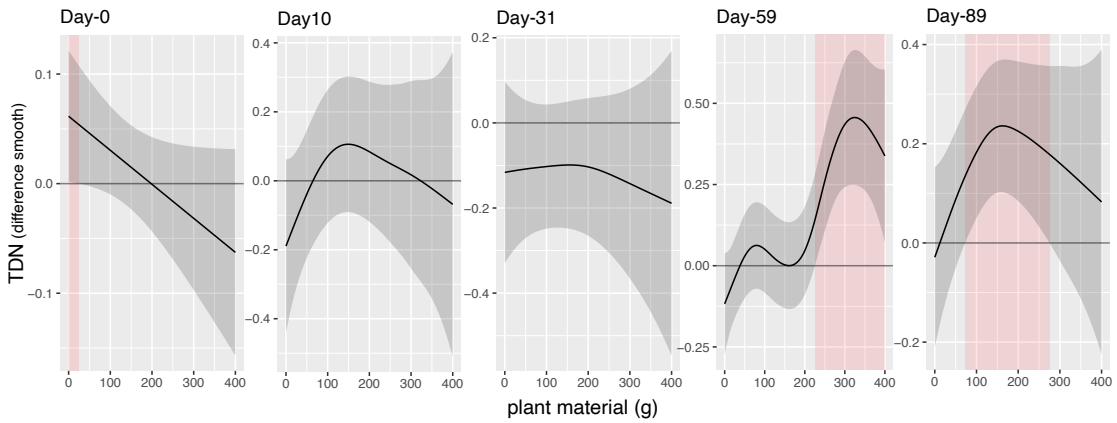

Figure S4. Model effects from GAMs with differences between smoothers for TN across time in treatments receiving burned and unburned plant material. Shaded regions are the confidence interval for 'the difference smooth,' which is the difference between burned and unburned treatment smoothers. Significant differences between treatment-level smoothers are noted in regions that do not include zero ± model confidence intervals and are shaded in pink.

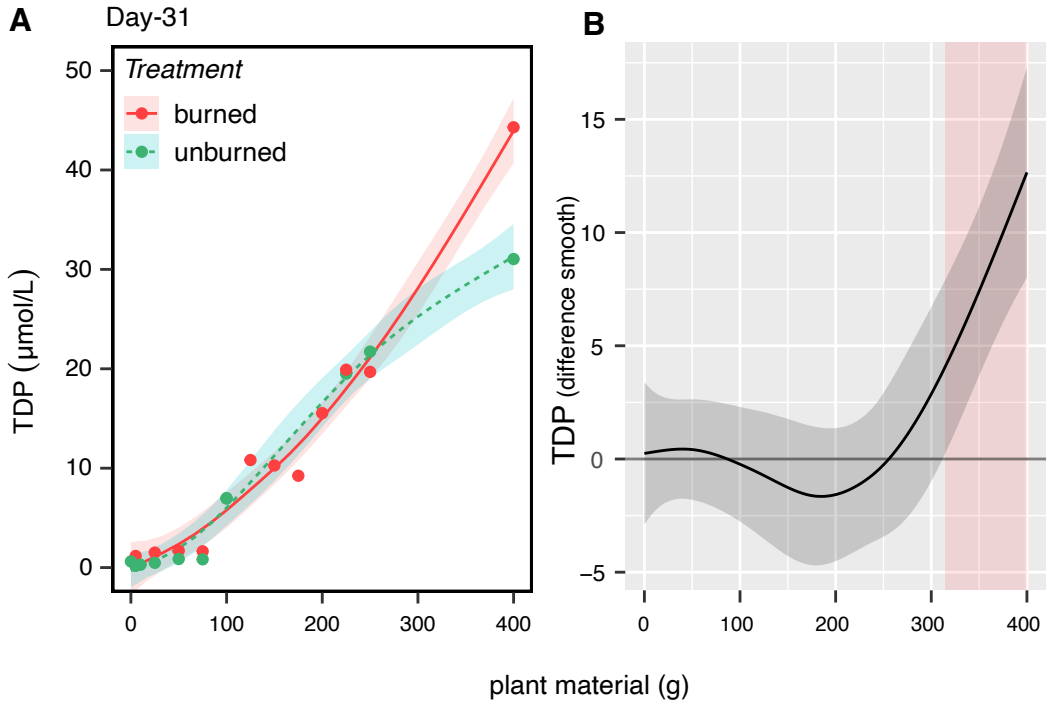

Figure S5. (A) Total phosphorus concentration in water from burned and unburned treatments at Day-31, and **(B)** the difference between burned and unburned treatment smoothers. Lines in *A* represent best-fit generalized additive models (GAMs) with treatment-level 95% confidence intervals. Lines in *B* represent differences between treatment-level smoothers, where significant differences (shaded in pink) are noted in regions that do not include zero ± model confidence intervals.

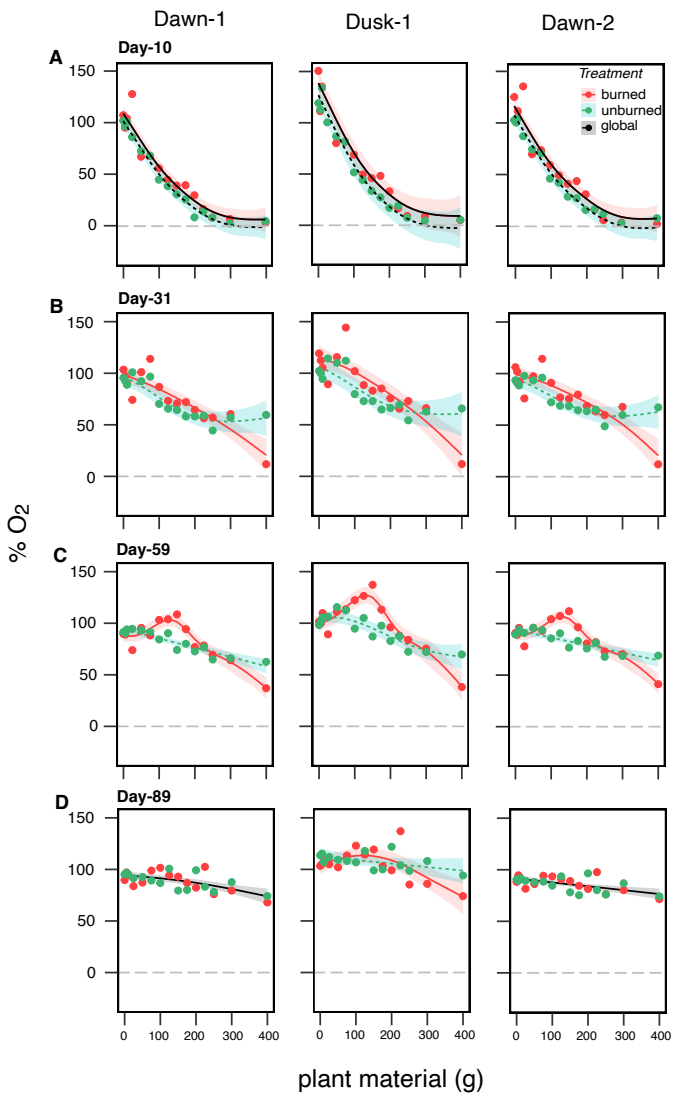

Figure S6. (A-D) Changes in dissolved oxygen concentration (%) at dawn and dusk across the four experimental period. Data here were used to calculate net ecosystem production and respiration. Lines represent best-fit generalized additive models (GAMs) with treatment-level 95% confidence intervals. Black lines with gray confidence intervals indicate global smoothers across all data points; solid (*burned*) and dotted (*unburned*) black lines together represent treatment-level intercepts with global smoothers; colored lines indicate factor-smooths that vary between treatments.

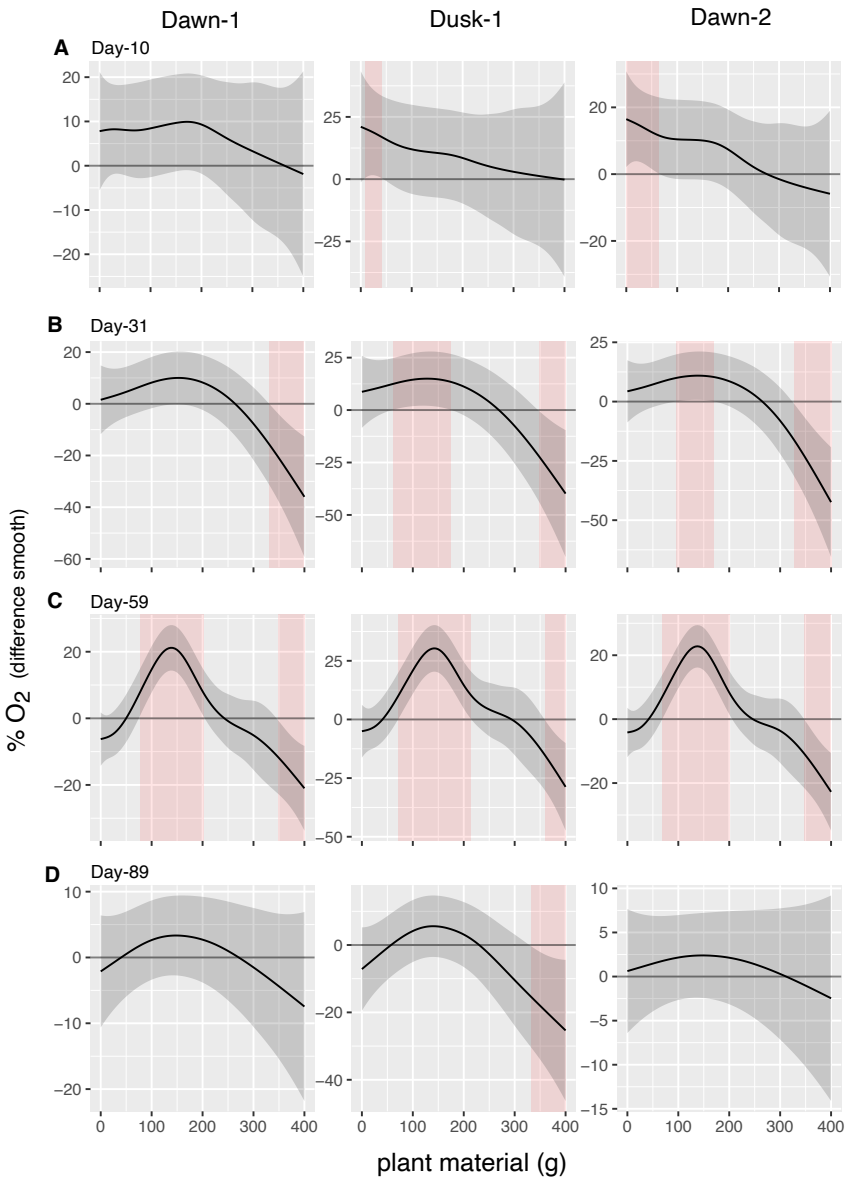

Figure S7. (**A-D**) Model effects from GAMs with differences between smoothers for oxygen concentration (% O_2) across four experimental time points in treatments receiving burned and unburned plant material. Shaded regions are the confidence interval for 'the difference smooth,' which is the difference between burned and unburned treatment smoothers. Significant differences between treatment-level

smoothers are noted in regions that do not include zero ± model confidence intervals and are shaded in pink.

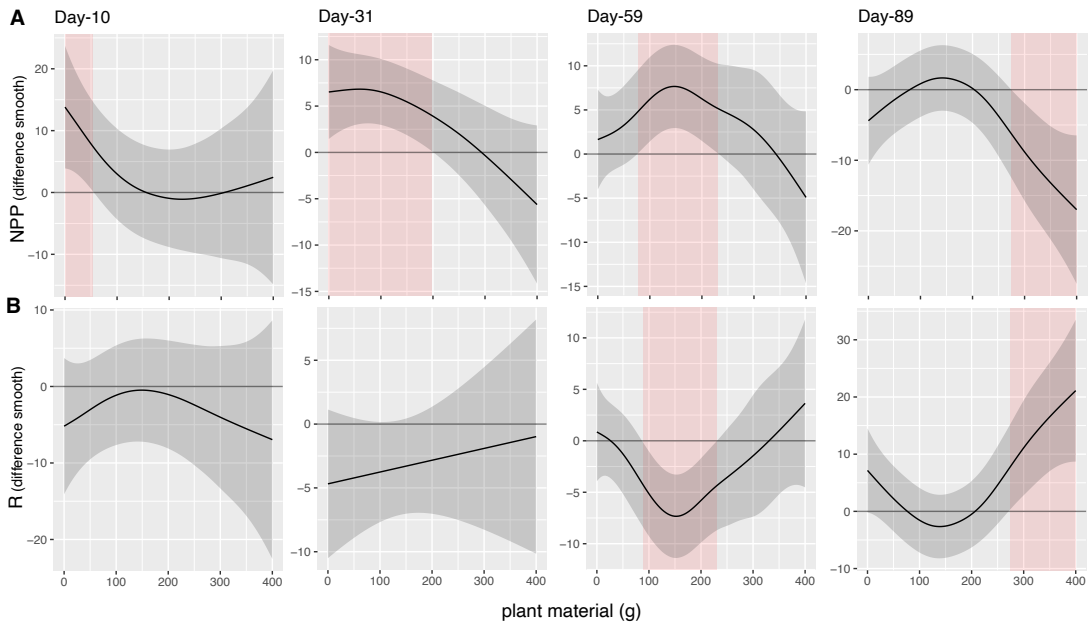

Figure S8. Model effects from GAMs with differences between smoothers for (**A**) net primary production (NPP) and (**B**) respiration (R) across time in treatments receiving burned and unburned plant material. Shaded regions are the confidence interval for 'the difference smooth,' which is the difference between burned and unburned treatment smoothers. Significant differences between treatment-level smoothers are noted in regions that do not include zero ± model confidence intervals and are shaded in pink.

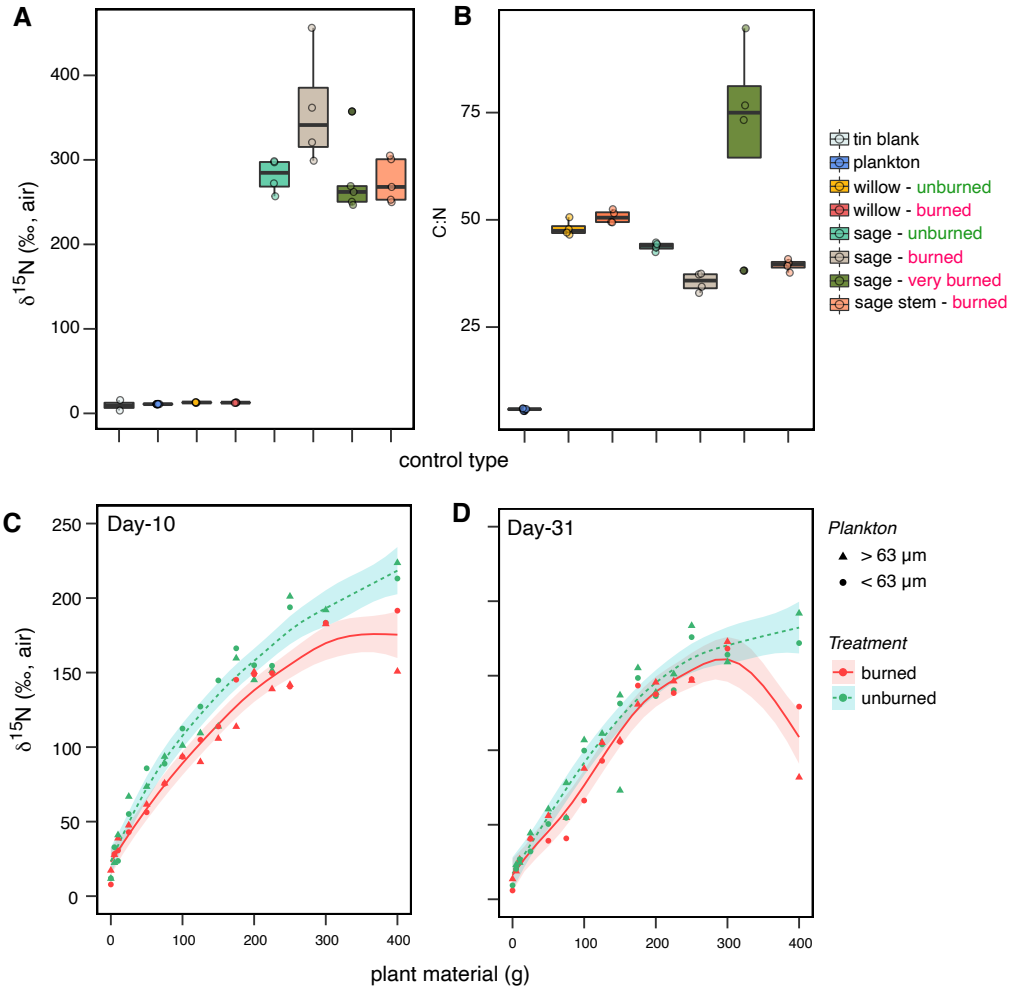

Figure S9. (A) Nitrogen isotope values and **(B)** C:N ratio for experimental controls (tin blanks), stock plankton, and burned or unburned plant material (willow, sage). **(C, D)** Nitrogen isotope values of plankton fractions in burned and unburned treatments at Day-10 (Time-1) and Day-31 (Time-2). Lines in the bottom panel represent GAMs fit to data with 95% confidence intervals. Box plots depict the median (bold center line), first and third quartiles (lower and upper bounds), whiskers (1.5x the distance between first and third quartiles), and outliers (black circles).

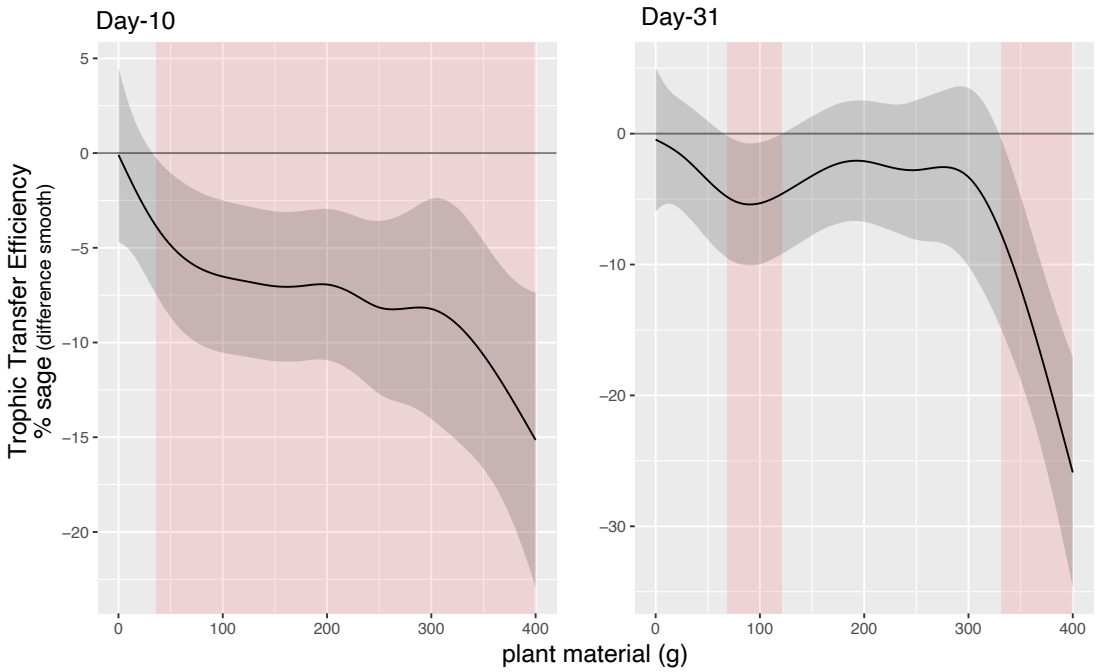

Figure S10. Model effects from GAMs with differences between smoothers for % sage-derived ^{15}N at Day-10 and Day-31 in tanks receiving burned and unburned plant material. Significant differences between treatment-level smoothers are noted in regions that do not include zero ± model confidence intervals and are shaded in pink.

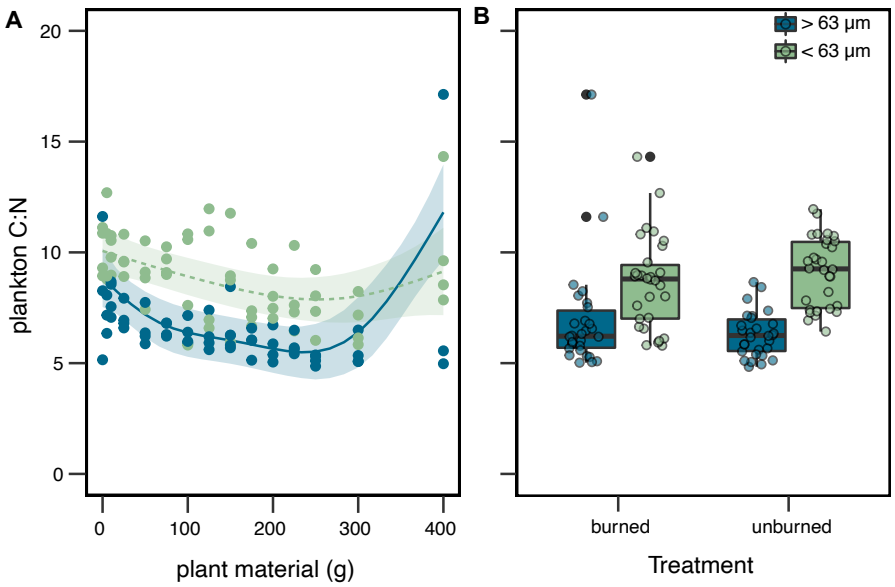

Figure S11. (A) Plankton C:N along the plant material gradient pooled across days (10 and 31) and treatments (burned and unburned), and **(B)** plankton C:N in treatment tanks receiving burned and unburned plant material. Lines represent GAMs (*top*) with treatment-level 95% confidence intervals. Box plots depict the median (bold center line), first and third quartiles (lower and upper bounds), whiskers (1.5x the distance between first and third quartiles), and outliers (black circles).

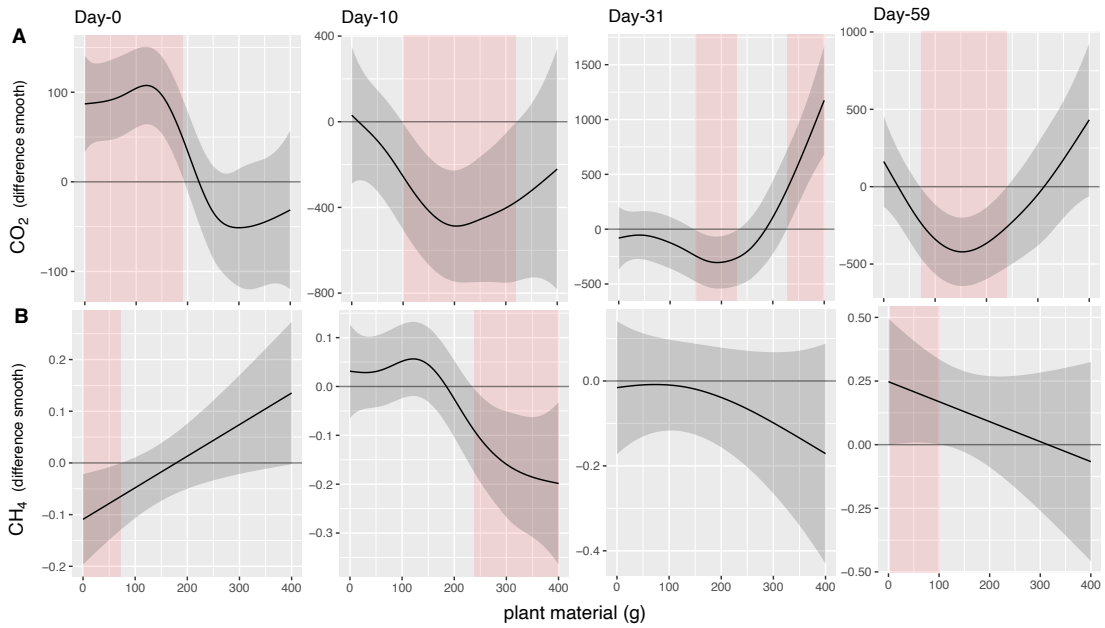

Figure S12. Model effects from GAMs with differences between smoothers for greenhouse gasses **(A)** carbon dioxide (CO_2) and **(B)** methane (CH_4) in tanks receiving burned and unburned plant material at the beginning of the experiment and during three experimental time points. Significant differences between treatment-level smoothers are noted in regions that do not include zero ± model confidence intervals and are shaded in pink.

Table S1. Linear models testing the influence of treatment (burned vs. unburned) plant material (leaf, stem) on sage biomass prior to addition to aquatic mesocosms. Factor interactions were excluded, except for their three-way interaction, which allowed for *a priori* contrasts of burning effects within plant tissue types in a single species.

Sage biomass	*Effect*	*SS*	*df*	*F*	*p-value*
Nitrogen (%N)	Treatment	0.028	1	8.663	**0.019**
	Type	0.260	1	80.525	**<0.001**
	Treatment:Type	0.071	1	21.810	**0.002**
	Residual	0.026	8		
Phosphorus (%P)	Treatment	0.001	1	1.968	0.198
	Type	0.008	1	19.306	**0.002**
	Treatment:Type	0.0001	1	0.144	0.714
	Residual	0.003	8		
Potassium (%K)	Treatment	0.256	1	7.616	**0.025**
	Type	0.180	1	5.357	**0.049**
	Treatment:Type	0.074	1	2.188	0.177
	Residual	0.269	8		
Sulfur (%S)	Treatment	0.0001	1	0.132	0.726
	Type	0.112	1	141.389	**<0.001**
	Treatment:Type	00004	1	0.489	0.504
	Residual	0.006	8		
Zinc (Zn ppm)	Treatment	3,073	1	2.336	0.165
	Type	3,281	1	2.494	0.153
	Treatment:Type	1,236	1	0.940	0.361
	Residual	10,524	8		

ANOVA table generated from Type-III sum of squares using *car* package in R. *SS* = sum of squares; *df* = degrees of freedom; *MS* = mean sum of squares. Significant effects ($p<0.05$) are in bold.

Table S2. Linear models testing the influence of treatment (burned vs. unburned) plant material (leaf, stem) on willow biomass prior to addition to aquatic mesocosms. Factor interactions were excluded, except for their three-way interaction, which allowed for *a priori* contrasts of burning effects within plant tissue types in a single species.

Willow biomass	*Effect*	*SS*	*df*	*F*	*p-value*
Nitrogen (%N)	Treatment	0.082	1	6.019	**0.044**
	Type	1.454	1	107.153	**<0.001**
	Treatment:Type	0.044	1	3.212	0.116
	Residual	0.095	7		
Phosphorus (%P)	Treatment	0.006	1	18.283	**0.004**
	Type	0.007	1	20.670	**0.003**
	Treatment:Type	0.001	1	2.513	0.157
	Residual	0.002	7		
Potassium (%K)	Treatment	0.068	1	8.034	**0.025**
	Type	0.264	1	31.358	**<0.001**
	Treatment:Type	0.002	1	0.173	0.690
	Residual	0.059	7		
Sulfur (%S)	Treatment	0.003	1	22.303	**0.002**
	Type	0.042	1	374.819	**<0.001**
	Treatment:Type	0.001	1	11.985	**0.011**
	Residual	0.001	7		
Zinc (Zn ppm)	Treatment	22,363	1	35.304	**<0.001**
	Type	21,956	1	34.663	**<0.001**
	Treatment:Type	5,340	1	8.431	**0.023**
	Residual	4,434	7		

ANOVA table generated from Type-III sum of squares using *car* package in R. *SS* = sum of squares; *df* = degrees of freedom; *MS* = mean sum of squares. Significant effects ($p<0.05$) are in bold.

Table S3. Model selection for percent dissolve organic carbon (DOC), total dissolved nitrogen (TDN), and total dissolved phosphorus (TDP) with candidate GAM models* assessed in each time point, corresponding to 0, 10, 31, 59, and 89 days post addition of burned or unburned plant material to experimental mesocosms. TDP was only measured at Day-31.

Metric	*Time*	*Model*	*df*	*AIC*	*ΔAIC*
DOC	Day-0	~Treatment + s(plant material, by= Treatment)	5.5	3.2	
		~Treatment + s(plant material)	4.0	1.0	
		~s(plant material)	3.1	**-0.8**	0.0
	Day-10	~Treatment + s(plant material, by= Treatment)	10.9	**146.8**	-15.2
		~Treatment + s(plant material)	6.6	157.8	
		~s(plant material)	5.5	162.0	
	Day-31	~Treatment + s(plant material, by= Treatment)	12.5	**117.7**	-40.3
		~Treatment + s(plant material)	6.3	160.0	
		~s(plant material)	5.3	158.0	
	Day-59	~Treatment + s(plant material, by= Treatment)	8.2	**64.0**	-12.1
		~Treatment + s(plant material)	4.0	69.7	
		~s(plant material)	3.0	76.1	
	Day-89	~Treatment + s(plant material, by= Treatment)	6.3	110.9	
		~Treatment + s(plant material)	5.4	109.3	
		~s(plant material)	4.4	**108.6**	0.0
TDN	Day-0	~Treatment + s(plant material, by= Treatment)	5.0	**-85.1**	-0.6
		~Treatment + s(plant material)	4.0	-83.4	
		~s(plant material)	3.0	-84.5	
	Day-10	~Treatment + s(plant material, by= Treatment)	8.9	-7.8	
		~Treatment + s(plant material)	6.2	-10.6	
		~s(plant material)	5.3	**-12.6**	0.0
	Day-31	~Treatment + s(plant material, by= Treatment)	6.3	-11.7	
		~Treatment + s(plant material)	6.9	**-18.1**	-3.0
		~s(plant material)	5.5	-15.0	
	Day-59	~Treatment + s(plant material, by= Treatment)	11.3	**-39.6**	-13.6
		~Treatment + s(plant material)	6.1	-26.2	
		~s(plant material)	5.1	-26.0	
	Day-89	~Treatment + s(plant material, by= Treatment)	7.0	**-23.7**	-6.4
		~Treatment + s(plant material)	4.8	-20.6	
		~s(plant material)	3.6	-17.4	
TDP	Day-31	Treatment + s(plant material, by=Treatment)	9.9	**100.1**	-16.8
		Treatment + s(plant material)	5.9	117.9	
		s(plant material)	4.8	116.9	

**Treatment + s(plant material, by= Treatment)* GAM has parametric terms (*Treatment*) and separate smoothers for each treatment. *Treatment + s(plant material)* GAM has a global smoother allowing for off-set intercepts according to treatments. The *s(plant material)* GAM fits a global smoother to all data. *Bold* represents the selected models. Delta AIC (*ΔAIC*) is the difference between the selected model and the global smoother model.

Table S4. Generalized additive models (GAM) testing treatment (burned vs. unburned) and factor-smooth interaction effects on dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) at five time points and total phosphorous (TP) at one time point. Separate smoothers were fit for burned and unburned data, and anova tables were generated by *anova.gam*().

	Effect	*df /edf*	*Ref.df*	*F*	*p-value*
Dissolved organic carbon (DOC mg/L)					
Day-0	s(plant material)	1.040	1.080	1.341	0.240
Day-10	Treatment	1	–	9.571	**0.005**
	s(plant material) : burned	3.623	4.412	119.7	**<0.001**
	s(plant material) : unburned	3.151	3.853	149.1	**<0.001**
Day-31	Treatment	1	–	0.035	0.853
	s(plant material) : burned	6.482	7.532	34.39	**<0.001**
	s(plant material) : unburned	1.568	1.929	59.34	**<0.001**
Day-59	Treatment	1	–	12.32	**0.002**
	s(plant material) : burned	2.051	2.532	94.00	**<0.001**
	s(plant material) : unburned	2.202	2.714	56.55	**<0.001**
Day-89	s(plant material)	1.928	2.385	29.80	**<0.001**
Total dissolved nitrogen (TDN mg/L)					
Day-0	Treatment	1	–	0.879	0.357
	s(plant material) : burned	1.000	1.000	0.009	0.927
	s(plant material) : unburned	1.000	1.000	6.303	**0.019**
Day-10	s(plant material)	2.848	3.492	5.720	**0.003**
Day-31	Treatment	1	–	4.122	0.053
	s(plant material)	3.207	3.921	4.870	**0.004**
Day-59	Treatment	1	–	3.500	0.075
	s(plant material) : burned	4.359	5.269	23.03	**<0.001**
	s(plant material) : unburned	2.457	3.022	10.52	**<0.001**
Day-89	Treatment	1	–	6.231	**0.020**
	s(plant material) : burned	2.417	2.973	3.613	**0.032**
	s(plant material) : unburned	1.000	1.000	0.531	0.473
Total dissolved phosphorus (TDP μmol/L)					
Day-31	Treatment	1	–	1.329	0.267
	s(plant material) : burned	2.924	3.525	154.7	**<0.001**
	s(plant material) : unburned	2.930	3.371	124.6	**<0.001**

Treatment indicates the parametric term in GAM, *s(plant material)* is the smooth term for either burned or unburned treatments. *df / edf* column indicates either *df* (degrees of freedom) for parametric terms or *edf* (effective degrees of freedom) for smoother terms; *Ref.df* = reference degree of freedom, where dashes indicate NA for parametric terms. Significant effects ($p<0.05$) are in bold.

Table S5. Model selection for percent dissolved oxygen (DO as % O_2) with candidate GAM models* assessed in each time point, corresponding to Days-10, 31, 59, and 89 post addition of burned or unburned plant material to experimental mesocosms. Dawn and dusk measurements represent discrete back-to-back measurements over a 24 h period.

Metric	*Time*		*Model*	*df*	*AIC*	*ΔAIC*
% O_2	Day-10	dawn-1	~Treatment + s(plant material, by= Treatment)	9.7	226.4	
			~Treatment + s(plant material)	6.7	**221.5**	-3.9
			~s(plant material)	5.6	225.4	
		dusk-1	~Treatment + s(plant material, by= Treatment)	9.3	258.5	
			~Treatment + s(plant material)	6.5	**254.3**	-3.1
			~s(plant material)	5.4	257.4	
		dawn-2	~Treatment + s(plant material, by= Treatment)	9.9	230.6	
			~Treatment + s(plant material)	6.8	**228.9**	-4.7
			~s(plant material)	5.6	233.6	
	Day-31	dawn-1	~Treatment + s(plant material, by= Treatment)	8.4	**231.2**	-4.8
			~Treatment + s(plant material)	4.0	237.8	
			~s(plant material)	3.0	236.0	
		dusk-1	~Treatment + s(plant material, by= Treatment)	8.2	**246.9**	-4.3
			~Treatment + s(plant material)	4.0	251.7	
			~s(plant material)	3.0	251.2	
		dawn-2	~Treatment + s(plant material, by= Treatment)	8.8	**229.5**	-7.4
			~Treatment + s(plant material)	4.0	238.5	
			~s(plant material)	3.0	237.0	
	Day-59	dawn-1	~Treatment + s(plant material, by= Treatment)	10.0	**198.3**	-22.8
			~Treatment + s(plant material)	6.5	222.3	
			~s(plant material)	5.5	221.1	
		dusk-1	~Treatment + s(plant material, by= Treatment)	12.4	**215.3**	-22.9
			~Treatment + s(plant material)	6.9	237.2	
			~s(plant material)	5.9	238.2	
		dawn-2	~Treatment + s(plant material, by= Treatment)	10.2	**195.7**	-25.4
			~Treatment + s(plant material)	6.6	221.4	
			~s(plant material)	5.5	221.1	
	Day-89	dawn-1	~Treatment + s(plant material, by= Treatment)	6.5	208.2	
			~Treatment + s(plant material)	5.0	208.2	
			~s(plant material)	4.1	**206.3**	0.0
		dusk-1	~Treatment + s(plant material, by= Treatment)	7.1	**229.0**	-2.0
			~Treatment + s(plant material)	5.6	232.5	
			~s(plant material)	4.7	231.0	
		dawn-2	~Treatment + s(plant material, by= Treatment)	6.0	198.5	
			~Treatment + s(plant material)	4.0	196.6	
			~s(plant material)	3.1	**195.0**	0.0

**Treatment + s(plant material, by= Treatment)* GAM has parametric terms (*Treatment*) and separate smoothers for each treatment. *Treatment + s(plant material)* GAM has a global smoother allowing for off-set intercepts according to treatments. The *s(plant material)* GAM fits a global smoother to all data. *Bold* represents the selected models. Delta AIC (*ΔAIC*) is the difference between the selected model and the global smoother model.

Table S6. Generalized additive models (GAM) testing treatment (burned vs. unburned) and factor-smooth interaction effects on dissolved oxygen measured at dawn, dusk, and dawn over a 24 h period. Separate smoothers were fit for burned and unburned data, and anova tables were generated by *anova.gam*().

Dissolved oxygen (% O_2)						
		Effect	*df /edf*	*Ref.df*	*F*	*p-value*
Day-10	dawn-1	Treatment	1	–	5.467	**0.028**
		s(plant material)	3.516	4.287	127.7	**<0.001**
	dusk-1	Treatment	1	–	4.718	**0.040**
		s(plant material)	3.225	3.942	73.89	**<0.001**
	dawn-2	Treatment	1	–	6.333	**0.019**
		s(plant material)	3.481	4.245	114.0	**<0.001**
Day-31	dawn-1	Treatment	1	–	0.309	0.584
		s(plant material) : burned	1.844	2.282	32.91	**<0.001**
		s(plant material) : unburned	2.508	3.083	14.25	**<0.001**
	dusk-1	Treatment	1	–	1.887	0.182
		s(plant material) : burned	2.026	2.503	25.65	**<0.001**
		s(plant material) : unburned	2.190	2.699	10.07	**<0.001**
	dawn-2	Treatment	1	–	0.744	0.397
		s(plant material) : burned	2.289	2.818	27.35	**<0.001**
		s(plant material) : unburned	2.411	2.966	10.64	**<0.001**
Day-59	dawn-1	Treatment	1	–	1.656	0.212
		s(plant material) : burned	4.970	5.958	23.28	**<0.001**
		s(plant material) : unburned	1.000	1.000	52.88	**<0.001**
	dusk-1	Treatment	1	–	6.275	**0.021**
		s(plant material) : burned	5.038	6033	24.8	**<0.001**
		s(plant material) : unburned	2.753	3.377	14.67	**<0.001**
	dawn-2	Treatment	1	–	3.860	**0.062**
		s(plant material) : burned	5.166	6.175	22.80	**<0.001**
		s(plant material) : unburned	1.000	1.000	38.78	**<0.001**
Day-89	dawn-1	s(plant material)	1.667	2.061	9.333	**<0.001**
	dusk-1	Treatment	1	–	0.506	0.483
		s(plant material) : burned	2.575	3.163	5.636	**0.004**
		s(plant material) : unburned	1.000	1.000	2.538	0.124
	dawn-2	s(plant material)	1.041	1.081	15.09	**<0.001**

Treatment indicates the parametric term in GAM, *s(plant material)* is the smooth term for either burned or unburned treatments. *df* = degrees of freedom for parametric terms; *edf* = effective degrees of freedom for smoother terms; *Ref.df* = reference degree of freedom, where dashes indicate NA for parametric terms. Significant effects ($p<0.05$) are in bold.

Table S7. Model selection for net primary productivity (NPP) and respiration (R) with candidate GAM models* assessed at 4 time points post addition of burned or unburned plant material to experimental mesocosms.

Metric	*Time*	*Model*	*df*	*AIC*	*ΔAIC*
NPP	Day-10	~Treatment + s(plant material, by= Treatment)	8.1	214.2	-0.9
		~Treatment + s(plant material)	6.1	**213.5**	
		~s(plant material)	5.0	214.4	
	Day-31	~Treatment + s(plant material, by= Treatment)	6.4	177.5	-9.3
		~Treatment + s(plant material)	7.7	**176.3**	
		~s(plant material)	4.2	185.6	
	Day-59	~Treatment + s(plant material, by= Treatment)	11.0	175.7	-6.0
		~Treatment + s(plant material)	7.3	**175.2**	
		~s(plant material)	6.1	181.2	
	Day-89	~Treatment + s(plant material, by= Treatment)	7.4	**187.4**	-5.2
		~Treatment + s(plant material)	5.8	192.2	
		~s(plant material)	4.8	192.5	
R	Day-10	~Treatment + s(plant material, by= Treatment)	8.0	207.9	
		~Treatment + s(plant material)	6.1	203.6	
		~s(plant material)	5.1	**203.3**	0.0
	Day-31	~Treatment + s(plant material, by= Treatment)	5.0	189.6	
		~Treatment + s(plant material)	9.6	**173.3**	-6.4
		~s(plant material)	8.3	179.7	
	Day-59	~Treatment + s(plant material, by= Treatment)	11.6	**164.9**	-5.8
		~Treatment + s(plant material)	7.4	167.6	
		~s(plant material)	6.3	170.8	
	Day-89	~Treatment + s(plant material, by= Treatment)	7.5	**196.9**	-7.0
		~Treatment + s(plant material)	6.0	202.9	
		~s(plant material)	4.9	203.9	

**Treatment + s(plant material, by= Treatment)* GAM has parametric terms (*Treatment*) and separate smoothers for each treatment. *Treatment + s(plant material)* GAM has a global smoother allowing for off-set intercepts according to treatments. The *s(plant material)* GAM fits a global smoother to all data. *Bold* represents the selected models. Delta AIC (*ΔAIC*) is the difference between the selected model and the global smoother model.

Table S8. Generalized additive models (GAM) testing treatment (burned vs. unburned) and factor-smooth interaction effects on net primary productivity (NPP) and respiration (R) at 4 time points following the addition of plant material to experimental mesocosm. Separate smoothers were fit for burned and unburned data, and ANOVA tables were generated by *anova.gam*().

	Effect	*df /edf*	*Ref.df*	*F*	*p-value*
Net primary productivity (NPP Δ % O_2)					
Day-10	Treatment	1	–	2.626	0.117
	s(plant material)	2.552	3.136	15.760	**<0.001**
Day-31	Treatment	1	–	8.479	**0.007**
	s(plant material)	3.867	4.699	4.856	**0.006**
Day-59	Treatment	1	–	7.304	**0.012**
	s(plant material)	3.719	4.525	8.277	**<0.001**
Day-89	Treatment	1	–	2.620	0.118
	s(plant material) : burned	2.757	3.382	3.717	**0.020**
	s(plant material) : unburned	1.000	1.000	1.002	0.327
Respiration (R Δ % O_2)					
Day-10	Treatment	1	–	1.520	0.229
	s(plant material)	2.533	3.113	13.000	**<0.001**
Day-31	Treatment	1	–	6.443	**0.019**
	s(plant material)	5.710	6.758	10.000	**<0.001**
Day-59	Treatment	1	–	5.669	**0.027**
	s(plant material) : burned	3.762	4.576	13.144	**<0.001**
	s(plant material) : unburned	3.274	4.000	7.775	**<0.001**
Day-89	Treatment	1	–	3.380	0.078
	s(plant material) : burned	2.927	3.587	5.293	**0.004**
	s(plant material) : unburned	1.000	1.000	0.002	0.965

Treatment indicates the parametric term in GAM, *s(plant material)* is the smooth term for either burned or unburned treatments. *df* = degrees of freedom for parametric terms; *edf* = effective degrees of freedom for smoother terms; *Ref.df* = reference degree of freedom, where dashes indicate NA for parametric terms. Significant effects ($p<0.05$) are in bold.

Table S9. Non-parametric Mann-Whitney *U*-test and linear models testing effects of treatments (burned vs. unburned) and sample types (^{15}N-labeled sage, non-labeled willow, and plankton stock) on nitrogen isotope values (δ^{15}N) and C:N ratios prior to the start of the experiment (Day-0).

Mann-Whitney *U*-tests

Metric	*Material*	*Contrast*	*U*	*p-value*
δ^{15}N	Leaf material	willow *vs*. sage	315	**<0.001**
C:N			160	**0.014**
δ^{15}N	Willow, plankton	willow *vs*. plankton stock	28	**0.001**
C:N			28	**0.001**

Linear models

Metric	*Material*	*Effect*	*df*	*SS*	*MS*	*F*	*p-value*
sage-δ^{15}N	Leaf material	Treatment	2	5,178	2,589	0.913	0.423
		Residual	15	42,461	2,837		
sage-C:N		Treatment	2	3,011	1,505	11.320	**0.001**
		Residual	13	1729	133		
willow-δ^{15}N		Treatment	1	0.050	0.050	0.554	0.485
		Residual	6	0.538	0.090		
willow-C:N		Treatment	1	14.773	14.773	5.279	0.061
		Residual	6	16.789	2.798		

Sample size is *n*=7 (plankton), *n*=18 (sage), *n*=8 (willow).

Table S10. Model selection using plankton of two size classes (< 63 and >63 μm) and measuring the trophic transfer (percent sage-^{15}N) in plankton biomass determined using a two-member mixing model and their stable isotope values (δ^{15}N). Candidate GAM models* were assessed in two each time points post addition of burned or unburned plant material to experimental mesocosms.

Metric	*Time*	*Model*	*df*	*AIC*	*ΔAIC*
% sage-^{15}N	Day-10	Treatment + Type + s(plant material, by=Treatment)	12.9	**354.1**	-26.7
		Treatment + Type + s(plant material)	8.7	359.8	
		s(plant material)	6.0	380.8	
	Day-31	Treatment + Type + s(plant material, by=Treatment)	12.8	**367.5**	-24.1
		Treatment + Type + s(plant material)	8.2	385.6	
		s(plant material)	6.1	391.6	
δ^{15}N	Day-10	Treatment + Type + s(plant material, by=Treatment)	12.9	**479.4**	-26.7
		Treatment + Type + s(plant material)	8.7	485.1	
		s(plant material)	6.0	506.1	
	Day-31	Treatment + Type + s(plant material, by=Treatment)	12.8	**492.7**	-24.1
		Treatment + Type + s(plant material)	8.2	510.8	
		s(plant material)	6.1	516.8	

* *Treatment + Type* represent parametric terms that provide offsets for either separate smoothers for each treatment *s(plant material, by=Treatment* or global smoothers *s(plant material)*. *Bold* represents the selected models. Delta AIC (*ΔAIC*) is the difference between the selected model and the global smoother model.

Table S11. Generalized additive models (GAM) testing treatment (burned vs. unburned) and type (< 63 μm, > 63 μm) and factor-smooth interaction effects on trophic transfer (plankton percent sage-^{15}N) calculated from a two-member mixing model. Separate smoothers were fit for burned and unburned data, and ANOVA tables were generated by *anova.gam*().

Plankton % sage-^{15}N					
	Effect	*df / edf*	*Ref.df*	*F*	*p-value*
Day-10	Treatment	1	–	31.261	**<0.001**
	Type	1	–	1.721	0.196
	s(plant material) : burned	3.560	4.338	136.8	**<0.001**
	s(plant material) : unburned	3.921	4.762	173.6	**<0.001**
Day-31	Treatment	1	–	13.082	**<0.001**
	Type	1	–	1.004	0.321
	s(plant material) : burned	4.669	5.621	79.45	**<0.001**
	s(plant material) : unburned	3.34	4.082	125.45	**<0.001**

Treatment indicates the parametric term in GAM, *s(plant material)* is the smooth term for either burned or unburned treatments. *df / edf* column indicates either *df* (degrees of freedom) for parametric terms or *edf* (effective degrees of freedom) for smoother terms; *Ref.df* = reference degree of freedom, where dashes indicate NA for parametric terms. Significant effects ($p<0.05$) are in bold.

Table S12. Model selection for greenhouse gas concentrations – carbon dioxide (CO_2 μM) and methane (CH_4 nM) – with candidate GAM models* assessed in before and 3 time point after the addition of burned or unburned plant material to experimental mesocosms.

Metric	*Time*	*Model*	*df*	*AIC*	*ΔAIC*
CO_2	Day-0	Treatment +s(plant material, by=Treatment)	8.9	**161.3**	-20.3
		Treatment + s(plant material)	4.0	176.0	
		s(plant material)	3.0	181.6	
	Day-10	Treatment +s(plant material, by=Treatment)	9.2	**271.2**	-8.1
		Treatment + s(plant material)	6.6	272.9	
		s(plant material)	5.4	279.3	
	Day-31	Treatment +s(plant material, by=Treatment)	10.2	**269.6**	-14.1
		Treatment + s(plant material)	4.0	285.4	
		s(plant material)	3.0	283.7	
	Day-59	Treatment +s(plant material, by=Treatment)	7.2	**268.0**	-8.8
		Treatment + s(plant material)	5.4	277.1	
		s(plant material)	4.3	276.8	
CH_4	Day-0	Treatment +s(plant material, by=Treatment)	5.0	132.5	-0.2
		Treatment + s(plant material)	4.0	**131.1**	
		s(plant material)	3.0	131.3	
	Day-10	Treatment +s(plant material, by=Treatment)	9.3	**159.3**	-5.3
		Treatment + s(plant material)	6.0	166.3	
		s(plant material)	5.1	164.6	
	Day-31	Treatment +s(plant material, by=Treatment)	5.9	197.8	
		Treatment + s(plant material)	4.0	196.3	
		s(plant material)	3.0	**194.9**	0.0
	Day-59	Treatment +s(plant material, by=Treatment)	5.0	227.5	
		Treatment + s(plant material)	7.1	**223.5**	-2.3
		s(plant material)	5.9	225.8	

**Treatment + s(plant material, by= Treatment)* GAM has parametric terms (*Treatment*) and separate smoothers for each treatment. *Treatment + s(plant material)* GAM has a global smoother allowing for off-set intercepts according to treatments. The *s(plant material)* GAM fits a global smoother to all data. *Bold* represents the selected models. Delta AIC (*ΔAIC*) is the difference between the selected model and the global smoother model.

Table S13. Generalized additive models (GAM) testing treatment (burned vs. unburned) and factor-smooth interaction effects on carbon dioxide (CO_2) and methane (CH_4) emissions from experimental mesocosms. Separate smoothers were fit for burned and unburned data, and ANOVA tables were generated by *anova.gam*().

Carbon dioxide (µM)					
	Effect	*df /edf*	*Ref.df*	*F*	*p-value*
Day-0	Treatment	1	–	14.980	**<0.001**
	s(plant material) : burned	1.000	1.000	10.566	**0.004**
	s(plant material) : unburned	4.022	4.880	3.383	**0.024**
Day-10	Treatment	1	–	9.403	**0.005**
	s(plant material) : burned	2.047	2.527	155.7	**<0.001**
	s(plant material) : unburned	2.966	3.633	144.2	**<0.001**
Day-31	Treatment	1	–	0.427	0.520
	s(plant material) : burned	2.499	3.072	52.20	**<0.001**
	s(plant material) : unburned	3.422	4.176	22.47	**<0.001**
Day-59	Treatment	1	–	2.341	0.140
	s(plant material) : burned	2.744	3.366	11.86	**<0.001**
	s(plant material) : unburned	1.000	1.000	28.09	**<0.001**
Methane (nM)					
Day-0	Treatment	1	–	2.038	0.166
	s(plant material)	1.000	1.000	0.718	0.405
Day-10	Treatment	1	–	0.266	0.611
	s(plant material) : burned	1.813	2.244	0.890	0.427
	s(plant material) : unburned	3.346	4.086	6.530	**0.001**
Day-31	s(plant material)	1	1.001	0.190	0.667
Day-59	Treatment	1	–	3.645	0.068
	s(plant material)	3.381	4.127	2.038	0.113

Treatment indicates the parametric term in GAM, *s(plant material)* is the smooth term for either burned or unburned treatments. *df* = degrees of freedom for parametric terms; *edf* = effective degrees of freedom for smoother terms; *Ref.df* = reference degree of freedom, where dashes indicate NA for parametric terms. Significant effects ($p<0.05$) are in bold.