BRC Science Highlight
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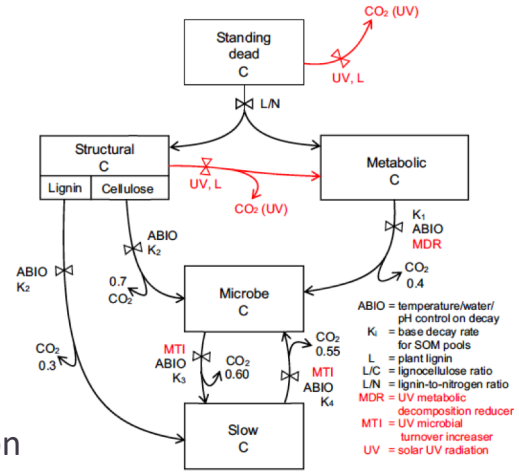
Photodegradation accelerates ecosystem N cycling in a simulated California grassland

Background/objective

Photodegradation accelerates litter decay in arid grasslands where plant growth and dead material decay are strongly controlled by precipitation and evapotranspiration. But the effects of photodegradation on ecosystem C and N dynamics are not well understood. We examined the effects using an ecosystem biogeochemical model, DayCent-UV, with photodegradation explicitly represented and validated.



Approach

- The model was parameterized for a California grassland where photodegradation was documented to release CO_2 from litter. The team took an inverse modeling approach using an extensive data set of six years of daily observed carbon and water gas exchange (gross primary production, ecosystem respiration, and evapotranspiration), soil temperature, and soil moisture.

Results

- Photodegradation in DayCent-UV accelerated C and N cycling, decreasing system C and N by 9.2% and 9.5%, respectively, and C and N residence times by 9.4% and 18.2%, respectively. Accelerated N cycling made a greater fraction of system N available for plants, increasing net N mineralization (due to decreased immobilization by microbes in aboveground organic matter) and plant production. Photodegradation did not alter the control on production by evapotranspiration.

Significance

- These results suggest that, at the ecosystem level, the central effect of photodegradation is to suppress microbial activity and accelerate N cycling.
- Adding the impact of photodegradation in DayCent-UV improves the ability to simulate the ecosystem impact of growing biofuel crops.

*Asao, S., Parton, W.J., Chen, M., and Gao. W. 2018. "Photodegradation accelerates ecosystem N cycling in a simulated California grassland." **Ecosphere** 9(8):e02370. 10.1002/ecs2.2370*

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