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Biogeosciences Discussions

Interactive comment on "Decreased summer drought affects plant productivity and soil carbon dynamics in Mediterranean woodland" *by* M. F. Cotrufo et al.

Anonymous Referee #3

Received and published: 11 August 2011

Review #1

Manuscript: Decreased summer drought affects plant productivity and soil carbon dynamics in Mediterranean woodland by Cotrufo et al.

The manuscript reports interesting results on the impact of altering precipitation inputs on soil carbon dynamics and plant productivity in a Mediterranean woodland in central Italy. As the authors discussed, precipitation patterns are likely to affect Mediterranean ecosystems and few studies have considered the impact of such changes on soil carbon dynamics. This is a relevant hot topic that suits the scope of Biogeochemistry. The paper is well-planned and presented and overall presents interesting results on the im-

pact of increased and decreased precipitation on soil carbon input and soil respiration. Therefore the study deserves publication after some revision. However, a few minor changes need to be made. Mainly some of the drawbacks in the Experimental design need to be further explained. The manuscript should be reorganised somewhat. Particularly the Discussion section (see below). Including some subsections may help in the text of the section (impact of rainfall manipulation on leaf litter fall and tree growth, impact on soil respiration and soil c input, etc.). Please, follow the suggestions below.

Title: add A Mediterranean woodland. The other point is that although the authors consider also decreased precipitation the title only refers to the decreased summer drought. Consider changing title to reflect the study.

Abstract

Line 10. Rephrase The throughfall manipulation experiment started in 2004 and we report data up to the 2009 growing season. The throughfall manipulation experiment started in 2004. We report five years results. OR Results are presented up to the 2008 But it is not really accurate as the do not present comparison with the control treatment over the five years. Sometimes year 2010 is mentioned.

Line 14. Compared to THE control TREATMENT.

Line 15. (equivalent to a 10% reduction IN precipitation).

Line 18. In Mediterranean woodlandS.

Line 21. Long-term carbon dynamics (add hyphon)

Line 23. Long-term soil C stocks. (add hyphon)

1. Introduction

5957. Line 12. remove the mean precipiation

5957 Line 19. substitute moisture for precipitation for consistency throughout the

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text.(precipitation, rainfall, rain, throughfall, moisture, water, many terms are used, choose one and use it throughout for consistency).

5958. Line 1-3. In addition, large complexity is associated to potential precipitation change as many processes may directly or indirectly respond to such change (Heisler and Weltzin, 2006. Rephrase, this sentence is not clear.

5958. Line 4. In Mediterranean forest ecosystems, (ADD COMMA)

5958. Line 6. substitute are with IS as it refers to increasing (subject), and THEIR annual carbon balance

5958. Line 12. of THESE two processes

5958. Line 14. consider changing to: have lasted a few years, have a duration of several years

5958. Line 14. and tend to focus on processes such as plant productivity or soil respiration, for which changes in process rates are high compared to the size of the rate itself, and where the response to the (REMOVE) climate drivers is generally fast.

5958. Line 19. Short-term

5958. Line 28, in pot EXPERIMENTS.

5958. Line 29. field studies (Hoosbeek et al., 2004). In this study, we use this method to estimate

Please, consistency in the spelling, either American (utilize) or British (utilise) throughout the text.

5959. Line 1. And to ASSESS or QUANTIFY rather than highlight

5959. Line 10. in A significant reduction IN soil C inputs.

5959. Line 19. in A Mediterranean woodland

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5959. Line 20. soil C stocks (change stores)

2. Material and Methods

5960 Line 4. long-term

5960 Line 5. irregularly distributed throughout the year? Rainfall in the Mediterranean region falls mainly during the winter, spring fall months with a prolonged summer drought??

5960 Line 6. The soil is classified as an Andisol (REMOVE COMMA) according to the USDA system, and has an average depth of 31 cm;

5960 Line 13. (i.e. 3 blocks of 3 treatments). Treatments plots were installed in April 2004 and control plots in April of 2006. This is incorrect, as control plots are also a treatment, three treatments. Treatments plots were installed in April 2004 and control plots in April of 2006. How is that the control plots were installed two years later? This is strange and should be explained why. In the abstract they state that the treatment plots were compared with control plots and that they report five years data. If this is the case, this is inaccurate. Please, rephrase.

5960 Line 19. The water used for irrigation was extracted from a well excavated at the 20 site for the purpose of this study (70 m depth).

5960 Line 26. For the dry treatment, 20 cm-width opaque drains placed 80 cm apart, were suspended below the canopy

5961 Line 6. In each plot, soil water content was measured continuously by time-domain reflectometry with two CS616-L probes connected to a CR10X data logger (Campbell Scientific, INC, Logan, UT, USA),

5962 Line 9. vertically inTO the soil.

5962 Line 10. In addition, a weather station was set-up near the experimental site to measure air temperature, air humidity, incoming solar radiation, rainfall, wind speed

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and direction. (DETAILS MISSING, PLEASE ADD).

5962 Line 12. 10 Hz??

5962 Line 18. From 2004 to 2010, The authors are reporting data up to 2009??

5962 Line 18.PLANT material

5962 Line 21. And DRY MASS determined when it reached constant weight (REMOVE THE BALANCE)

5962 Line 23. Arbutus. unedo leaf litter contributed more than 80% of the total standing litter at the site (data not shown). Therefore, litter production data are reported as means of annual A. unedo leaf litter production for each of the 25 experimental treatments. NOT CLEAR. What do they mean by as means of annual?? Why 25? They were 9 experimental plots, no treatments.

5962 Line 29. Tree growth was measured in 2009. Nine manual dendrometer bands were installed in each experimental plot on dominant Arbutus. unedo trees in April 2009 and measured IN September 2009 and again on April 2010. Again, data are reported till 2009.

5963 Line 9.Soil was collected from the USDA-ARS Central Plains Experimental Range located in NE Colorado, USA (40_490 N, 104_460W), classified as a Zigweid soil series Fineloamy, mixed, superactive, mesic Ustic Haplocambids), with a pH of 7.4. At the site plant cover of C4 grasses is approximately 75%,

5963 Line 15. For brevity we call this “C4 soil”. Replace with This soil is referred as to “C4 soil”.

5963 Line 16. “C4 soil”

5963 Line 17. soil was ground (remove roughly.. not needed)

5963 Line 18. And chemical analyses (%C and _13C)

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5963 Line 20. Soil cores

5963 Line 21. the ENTRY

5963 Line 28. demineralised change to American spelling demineraliZed for consistency

5963 Line 28. Both, soil and root samples,

5964 Line 1. In AN oven (add article) pulveriZed and analyzed (American spelling)

5964 Line 16. where _soil is THE 13C of the organic matter of the from each SOIL core after

5964 Line 19 SOIL core

5964 Line 23. Continuous SR WAS MEASURED every two hours

5964 Line 25. (gCm$-$2 yr$-$1) in the wet and control treatments

5965 Line 6. The rate of increase of CO2 concentration within each chamber was used to estimate the soil CO2 efflux rate (μmol m$-$2 s$-$1) by an empirical diffusion model (Delle Vedove et al., 2007).

5965 Line 7. while two-way ANOVA

3. Results

5965 Line 20. MEAN Air temperature? 5966 Line 2. than twice as high in was more than doubled in the wet than in the control plots.

5966 Line 3. Due to the large variability in the annual growth rate of trees GROWN in THE dry TREATMENT, there were no significant differences between the dry and the other two treatments (p = 0.234)

5967 Line 11. In both OF the horizons, or better, IN BOTH HORIZONS, root C input was significantly LARGER (p<0.0001) in the wet treatment THAN IN the dry and control

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TREATMENTS, which did not differ from one another (Fig. 4).

5967 Line 24. responding to REMOVE increasing soil moisture (Fig. 5).

5967 Line 24. In 2009, the seasonal difference (SEASONAL VARIABILITY?) was much less pronounced, likely due to MOST LIKELY AS A RESULT OF the HIGHER soil moisture.WETTER conditions

5968 Line 6. This was further emphasized

5968 Line 7. correlation between SR, SOIL temperature which shows that high SR RATES

5968 Line 10. In contrast, in the control and dry treatments, high temperatures COINCIDED WITH low soil moisture content,

5968 Line 11. much lower SOIL respiration rates (SR as before)

5968 Line 14. appeared not TO

5968 Line 15. affect significantly either litterfall, SPP, soil C input or SOIL respiration.

5968 Line 16. INCREASED soil water content during summer months above (REMOVE) 10% v/v strongly

5968 Line 18. with respect to VALUES MEASURED IN THE control TREATMENT.

5968 Line 19. as compared to SR THAN IN SR.

5968 Line 20. the observed significant increase in net soil C input, which was stimulated by 220% AS (REMOVED) compared to the control

5968 Line 24. was 349, 351 and 759 gCm−2 yr−1, for the control, dry and wet treatmentS, respectively.

5968 Line 24 For the same year, total soil C output from (REMOVE) SR was 1195, 1357 and 1922 gCm−2 yr−1, for the control, dry and wet treatmentS, respectively

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5968 Line 27. While replace to WHEREAS

5969 Line 1. Similarly, total soil C output in THE wet TREATMENT exceeded the OUTPUT measured IN THE control TREAMENT by 727 gCm−2 yr−1 on average while there WERE NO SIGNIFICANT DIFFERENCES BETWEEN THE dry AND THE control TREATMENT.

4. Discussion 5969 Line 5-16. The entire first paraghaph is redundant, please remove. It has already been explained in MATERIAL AND METHODS.

5969 Line 17. While the summer irrigation treatment INCREASE soil moisture during THE summer months (REMOVE) compared to the control treatment and on average successfully maintained it above the targeted value of 10% v/v (Fig. 2), the 20% throughfall exclusion did not

5969 Line 20 significantly reduce soil water content. THESE ARE RESULTS, NOT DISCUSSION. Already presented in the RESULTS section.

5970 Line 8 Across all three treatments, differences in leaf litter fall among treatments were highly correlated with differences in annual water input, with an additional 10% leaf litter fall 10 every additional 100mm of rainfall a year (Fig. 3). These are results.

5970 Line 15. that receives an annual precipitation of 1700 to 3000 mm, but also characteriZed by a SIX month dry Season.

5970 Line 17. to the imposed drought stress, and in only one of the SEVEN years of the experimental manipulation was REMOVE significantly reduced with respect to the control.

5970 Line 20. compared to the wet TREATMENT (do they mean CONTROL TREATMENT?)

5970 Line 24. In our ECOsystem (or STUDY site), nitrate production is inhibited AS A RESULT OF allelopathic reactions (Castaldi et al., 25 2009) and plants uptake N

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primarily as ammonium, which is less mobile THAN NITRATE.

5970 Line 27. belowground C cycling, with similar rates of net root-derived C input and soil respiration measured in the dry and control treatments, (REMOVE) it started to reduce leaf litter input LEAF LITTER WAS REDUCED

5970 Line 29. A decline in leaf level C-uptake in the dry TREAMENT HAS BEEN previously reported (Ripullone et al.,

5971 Line 6. reduction IN soil respiration,

5971 Line 9. decomposition to soil RESPIRATION at the site. (use the same terminology for consistency throughout the text)

5971 Line 10. As expected, increasED soil moisture during THE summer months to above 10% v/v,

5971 Line 14. AnalyZing 12 YEARS data on ANPP and precipitation at 11 Long

5971 Line 20. growth activity to short periods when precipitation FALLS, when SOIL MOISTURE is high generally in the (REMOVE) spring,

5971 Line 20. However, Mediterranean evergreen forests exhibit the ability to (REMOVE) start the growing season as soon as water becomes availa

5971 Line 22. drought-triggered false ring formation TOO MANY ADJECTIVES, considering changing to ; of false ring formation triggered by drought.

5971 Line 24. Soil water content IS OFTEN LIMITS soil respiration in Mediterranean regions

5972 Line 20. was not respired back to the atmosphere within a year, was highly enhanced by the summer irrigation treatment with 220% more “new” C being recovered in the wet TREATMENT than in the control TREAMENT (Fig. 4).REMOVE, these are presented in the REsults section.

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5972 Line 26. due to the fact that BECAUSE

5972 Line 30. SIX years (numbers smaller than 10 are spell out) 6 yr

5973 Line 2. compared to THE CONTROL TREATMENT

5973 Line 4. in THE DRY TREATMENT

5973 Line 6. compared to the dry TREAMENT after FOUR YEARS of exposure to a multi factorial,

5973 Line 8. soil in A restored grassland

5973 Line 9. a decadal-period (O'Brien et al., 2010), as the result of both,

5973 Line 10. rates AS A RESULT OF periodic seasonal inundation at THE WET site.

5973 Line 12. Unfortunately, we DID NOT partition soil respiration, but in Mediterranean deciduous forests, the percentage contribution of heterotrophic respiration to total soil CO2 efflux ranges between 48 TO 77% (Subke et al., 15 2006).

5973 Line 15. At our site,

Tables

Table 1. Details on amounts and timing of water additions to the wet treatment by irrigation, and cumulated with rainfall for the growing season NOT CLEAR REPHRASE (March to September), for the FIVE YEARS of the water manipulation experiment. For comparison, annual rainfall, rainfall during the growing season and long-term means (LTM, 1980–2010) are also provided.

Table 3. Litterfall production (gm$-$2 yr$-$1) in the control, dry and wet plots, for the five years of the throughfall manipulation experiment. Values are THE means $\pm$ 1 standard error (n=3). Within the same year, different letters indicate a significant difference among treatments ($p < 0.05$).

Table 4 should be eliminated and the three numbers reported in the text of the Results.

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Figures

What is the difference between Figure 1 panel b and Figure 2, REMOVE Figure 2.

Fig. 7. Daily soil respiration (gCm−2 d−1) as A function of soil water content (% v/v) and soil temperature (_C) for the wet, dry and control plots. Black dots represents measured values, while colored plain represents modeled respiration using Eq. (3) (see the text in the

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Interactive comment on Biogeosciences Discuss., 8, 5955, 2011.