

Data Paper

Hideki Kobayashi, Yongwon Kim, Taro Nakai, Hiroki Ikawa, Shin Nagai, Kyotaro Noguchi, Wei Yang, Akira Hama, Shinji Matsumura, Kyoko Ikeda, and Rikie Suzuki (Deceased). Ecosystem aboveground structures of an open-canopy black spruce forest in interior Alaska for ecosystem modeling. *Polar Data Journal*. 2023, 7, p. 72–88. <https://doi.org/10.20575/00000050>.

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1st submission

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Reviewer #1 (6/23/2023–6/28/2023)

Reviewer #2 (7/11/2023–8/1/2023)

Reviewer #1: Anonymous

The authors report a synthesis dataset of aboveground forest structural characteristics at the Poker Flat Research Range, Fairbanks in Subarctic Alaska. The data is important for understanding the carbon cycle and ecosystem services, as well as for assessing and predicting future impacts of environmental change on forest ecosystems.

As for the part about the background explanation, the authors argued that this data is necessary for testing and evaluating the ecosystem model. On the other hand, the authors also described that "A consensus has not yet been reached on the consequences of Arctic and boreal warming and, therefore, no land surface and ecosystem models have yet achieved sufficient consideration of the complex behaviors of permafrost soil and forest systems." I think that the authors' data do not directly reply to this problem. I recommend that the authors explain the importance of the data in a simpler and more concise.

Minor comments

1. Lines 36-38. Authors should state why testing and evaluation of ecosystem models are needed.
2. Line 70. It is curious about the position of Figure 3. Authors should state line 69 after Figure 1. If the authors agree, the number of Figures 2 and 3 should be changed.
3. Line 84. biomasswere => biomass were
4. Lines 85-86. Authors should explain in what ways the ecosystem model and land surface model are important. Since greenhouse gas flux is one of the functions of forest ecosystems, there is no need to describe the relationship

between the fluxes and functions here.

5. Lines 98-107. Since there are many measurement items, how about a list of measurement items? It would be easy to understand if authors make a list of measurement item names, measurement equipment, measurement interval, measurement start time, measurement location (position, height), measurement start year, etc.
6. Lines 135-136. Is there a reason why authors cannot describe it in detail? If so, there is no need to write this sentence itself.
7. Line 142. Authors mentioned that number of trees within the survey area was 357. Does this include the number of trees for which DBH was not measured?
8. Lines 172-173. Authors weighed the branches, but do the leaves remain attached when measuring or are they removed?
9. Lines 184-185. "From the resulting dry and ----- or branch height." I don't understand what authors are trying to convey here. Please be specific.
10. Line 200. It is difficult to distinguish 1 and l in the formula. It should be italicized or something to avoid misunderstanding.
11. Line 191. Although authors describe LMA is defined as leaf area per unit leaf dry mass, LMA is leaf mass per area. Authors should correct the definition.
12. Line 265. Authors should state how many leaves in each dominant species were collected and scanned.
13. Line 295. profile.csv: I can see a blue underline at ".". I do not think this underline is necessary.
14. Line 334. "Location_info" is listed as "location_info" in the database.
15. Fig. 2. Can authors get a higher resolution? Please note in the caption what the red dots indicate. Also, although the distance between each line is 50 m, the west side of C and D appears to be much narrower than the distance between A and B. If authors noted the distance between the lines, wouldn't it be better to indicate the actual width of the distance (**m to **m)?
16. Fig. 3. Please note the units of density on the Y-axis.
17. Fig. 4. The X-axis has a new value written on top of the original value, but the original value has not been completely erased, making it difficult to see. (d) It is labeled as Dry mass %, but the maximum value is 1.00. Which is correct? Also, authors should state that the values of dry mass are relative values in the figure caption.

Reviewer #2: Toshiyuki Ohtsuka

Detailed descriptions of forest ecosystem structures including understory plant communities are important for not only long-term community structural research but also ecological modeling.

Minor comments.

1. I do not understand the meaning of biomass profile (L73). You want to describe the vertical profiles of biomass?

2. Could you explain Figure 4 in more detail. What do the numbers on the horizontal axis represent?

Total weight might be needed (e.g., DW g m⁻²)

3. Figure 3. Unit of "Density"?

And what is the line on the histogram?

4. L128 "30×30m² plot within a flux footprint area"

Could you put the position of the plot in Figure 2? Where is the plot located?

Authors Response:

We would like to thank the reviewers for their constructive comments. We have addressed each comment by two reviewers and the manuscript has been substantially improved. We believe that the current version of the manuscript is suitable for publication in Polar Data Journal.

Hideki Kobayashi,
on behalf of the authors

Response to reviewer #1;

The authors report a synthesis dataset of aboveground forest structural characteristics at the Poker Flat Research Range, Fairbanks in Subarctic Alaska. The data is important for understanding the carbon cycle and ecosystem services, as well as for assessing and predicting future impacts of environmental change on forest ecosystems.

As for the part about the background explanation, the authors argued that this data is necessary for testing and evaluating the ecosystem model. On the other hand, the authors also described that "A consensus has not yet been reached on the consequences of Arctic and boreal warming and, therefore, no land surface and ecosystem models have yet achieved sufficient consideration of the complex behaviors of permafrost soil and forest systems." I think that the authors' data do not directly reply to this problem. I recommend that the authors explain the importance of the data in a simpler and more concise.

Thank you for your comments. The reviewer is right. We didn't answer this question. This question is a rather overarching issue in the model exercises and will need further effort beyond the current study. As suggested by the reviewer, we modified the description to make it simpler and more concise directly related to the issues in the current manuscript. We updated the description in the first paragraph. (Lines 55-62)

"To date, no land surface and ecosystem models have yet achieved sufficient consideration of the complex behaviors of permafrost soil and forest systems. This is due to the lack of comprehensive data sets to describe the realistic forest stand in the subarctic boreal forest, where tree stands are very sporadic and the majority of the forest understory is

directly illuminated by the sunlight. To establish accurate benchmarks for models and represent the current status of carbon stocks and flows, it is essential to provide detailed descriptions of forest ecosystem structures including understory plant communities alongside carbon flux data.”

Minor comments

1. Lines 36-38. Authors should state why testing and evaluation of ecosystem models are needed.

The description in lines 36-38 was not straightforward. What we would like to emphasize here is to establish accurate benchmarks for models and represent the current status of carbon stocks and flows, it is important to provide good data sets that describe the whole ecosystem structures including the understory plant communities. We replaced the original description with

“To establish accurate benchmarks for models and represent the current status of carbon stocks and flows, it is essential to provide detailed descriptions of forest ecosystem structures including understory plant communities alongside carbon flux data.” (Lines 36-38 and 59-61)

2. Line 70. It is curious about the position of Figure 3. Authors should state line 69 after Figure 1. If the authors agree, the number of Figures 2 and 3 should be changed.

Thank you for your suggestion. I fully agree with your comments. The order of Figures 2 and 3 has changed.

3. Line 84. biomasswere => biomass were

Fixed.

4. Lines 85-86. Authors should explain in what ways the ecosystem model and land surface model are important. Since greenhouse gas flux is one of the functions of forest ecosystems, there is no need to describe the relationship between the fluxes and functions here.

We have improved the statement in lines 85-86 in the previous manuscript. Our data sets are useful for the calibration of the forest stand representations in the ecosystem and land surface models and for the validation of the simulated forest growth and stand structures because there are limited data sets of forest structures in the subarctic boreal forests.

We have updated the descriptions:

“The ecosystem structure datasets described in this paper are useful for the calibration of the forest stand representations in the ecosystem and land surface models and for the validation of the simulated forest growth and stand structures.” (Line 47-49 & Line 98-100).

5. Lines 98-107. Since there are many measurement items, how about a list of measurement items? It would be easy to understand if authors make a list of measurement item names, measurement equipment, measurement interval, measurement start time, measurement location (position, height), measurement start year, etc.

The list of measurements has been added as the new Table 1. We also added a sentence “A list of existing micrometeorological and plant phenology monitoring in the study site are summarized in Table 1.” (lines 104-105)

6. Lines 135-136. Is there a reason why authors cannot describe it in detail? If so, there is no need to write this sentence itself.

Census locations are preserved for long-term monitoring of forest dynamics. We don't want other research groups to disturb the census site. It does not mean we will keep our site to be secret. If there is a reason to want to know the exact position, we are willing to provide the exact locations.

7. Line 142. Authors mentioned that number of trees within the survey area was 357. Does this include the number of trees for which DBH was not measured?

This number only contains the tree we measured DBH. We have modified the description as “measuring all 357 trees that we measured DBH” (Line 144)

8. Lines 172-173. Authors weighed the branches, but do the leaves remain attached when measuring or are they removed?

We removed all leaves before the branch weight measurements. We have added a comment “scale after removing all needles.” (Line 176)

9. Lines 184-185. "From the resulting dry and ----- or branch height." I don't understand what authors are trying to convey here. Please be specific.

In this description, we tried to explain that the average and the standard deviation of the dry and fresh fractions obtained from the eleven branch samples were 0.65 ± 0.09 . As the variation (coefficient of variation = 14%) of the fraction of dry weight/fresh weight was small, we decided to apply the average dry to fresh weight fraction to all branch elements regardless of dead or lived. We have modified the description as

“From the resulting dry to fresh weight fractions (dry weight/fresh weight), the average and the standard deviation of the dry and fresh fractions obtained from the eleven branch samples were 0.65 ± 0.09 . As the variation (coefficient of variation = 14%) of the fraction of dry weight/fresh weight was small, we decided to apply the average dry to fresh weight fraction to all branch elements regardless of “Dead” or “Live”.” (Lines 187-191)

10. Line 200. It is difficult to distinguish 1 and l in the formula. It should be italicized or something to avoid misunderstanding.

Thank you for your suggestion. We italicized variables used in this section. (Line 204)

11. Line 191. Although authors describe LMA is defined as leaf area per unit leaf dry mass, LMA is leaf mass per area. Authors should correct the definition.

Thank you. It was an error. We modified the definition “Leaf mass per area (LMA) is defined as leaf dry mass per unit leaf area (g m^{-2}).” (Line 195)

12. Line 265. Authors should state how many leaves in each dominant species were collected and scanned.

We agree that the sample size is important. As we have not counted the number of leaves because we collected many leaves, we decided to add the minimum to the maximum dry mass of the seven samples (sample weight $8.2 \text{ g} \sim 22.2 \text{ g}$

in dry mass). (Line 269)

13. Line 295. profile.csv: I can see a blue underline at ".". I do not think this underline is necessary.

Thank you so much. We removed the underline. (Line 298)

14. Line 334. "Location_info" is listed as "location_info" in the database.

Thank you so much. We modified "Location_info" to "location_info". (Line 337)

15. Fig. 2. Can authors get a higher resolution? Please note in the caption what the red dots indicate. Also, although the distance between each line is 50 m, the west side of C and D appears to be much narrower than the distance between A and B. If authors noted the distance between the lines, wouldn't it be better to indicate the actual width of the distance (**m to **m)?

Fig. 3 (Fig. 2 in the previous version) has been improved and now it has a higher resolution. The sampling locations and the distance between the transects are 50 m on average. However, it is fluctuated because we didn't have a centimeter scale GNSS equipment (e.g. RTK-GNSS). To avoid confusion, we removed "50m" from the map. Instead, we added the grid lines with 100m intervals. Readers can estimate the actual distances of the transect from these grid lines.

16. Fig. 3. Please note the units of density on the Y-axis.

"Density" was not accurate. The y-axis is the value of the probability distribution function fitted by the histogram distribution. We replaced "Density" to "PDF" and added some explanatory comments of PDF. The histograms are normalized to 1 to compare with the fitted PDF functions.

"Figure 2. Probability distribution functions (PDF) of DBH and tree height. (a) DBH in 2010, (b) DBH in 2014, (c) height in 2010, and (d) height in 2014. Dashed blue vertical lines indicate average values. The histograms of DBH and tree height are normalized to 1 to compare with PDF function." (Lines 374-376)

17. Fig. 4, The X-axis has a new value written on top of the original value, but the original value has not been completely erased, making it difficult to see. (d) It is labeled as Dry mass %, but the maximum value is 1.00.

Which is correct? Also, authors should state that the values of dry mass are relative values in the figure caption.

I'm sorry that the graphics were not perfectly created. We have updated the figure. Now the background are all erased. For Fig 4 (d), we have modified the y-axis. Now it has ranged from 0 to 100. We also added the word "fraction" in the label of y-axis so that the readers can recognized this is the fraction of dry biomass.

Response to reviewer #2;

Detailed descriptions of forest ecosystem structures including understory plant communities are important for not only long-term community structural research but also ecological modeling.

Thank you for your valuable comments. Here I summarized the response to your comments.

Minor comments.

1. I do not understand the meaning of biomass profile (L73). You want to describe the vertical profiles of biomass?

The description was not accurate. It was tree aboveground biomass and their vertical profiles as the reviewer guessed.

We modified the description as “tree aboveground biomass and their vertical profiles” (Lines 44-45, 67)

2. Could you explain Figure 4 in more detail. What do the numbers on the horizontal axis represent?

Total weight might be needed (e.g., DW g m⁻²)

Some important information was not provided. The numbers on the horizontal line is the sampling tree ID recorded in the published data. We have added the symbol “#” to indicate they are not natural number, but the ID of the tree. Total weights shown in the graph are the DW g per tree. We modified by adding the “/tree”

3. Figure 3. Unit of “Density”?

And what is the line on the histogram?

“Density” was not accurate. The y-axis is the value of the probability distribution function fitted by the histogram distribution. We replaced “Density” to “PDF” and added some explanatory comments of PDF. The histograms are normalized to 1 to compare with the fitted PDF functions.

“Figure 2. Probability distribution functions (PDF) of DBH and tree height. (a) DBH in 2010, (b) DBH in 2014, (c) height in 2010, and (d) height in 2014. Dashed blue vertical lines indicate average values. The histograms of DBH and tree height are normalized to 1 to compare with PDF function.” (Lines 374-376)

4. L128 “30×30m² plot within a flux footprint area”

Could you put the position of the plot in Figure 2? Where is the plot located?

We have added the census plot on Fig. 3 (Fig. 2 in the previous manuscript.)

2nd submission

Editor Start Date: 8/15/2023

Editor Stop Date: 8/16/2023

Editor comments to the Author: Sakae Kudoh

The revised draft is accurate and clear with appropriate responses to the reviewers' comments. The manuscript is considered acceptable after the following corrections are made.

1. There are unnecessary hyphens and superscripts that are not superscripted in some places. (ex. Line 81: 200-m, Line 99: CO₂, Line 100: 17-m, etc.) Please check the entire manuscript including figures and tables.
2. For Figure 2, add an explanation for the pink shaded curves behind the vertical lines.

Authors Response:

Thank you for your prompt reply. We really appreciate it. Here, I summarized comments from the editors. I hope this version is acceptable.

Hideki Kobayashi,
on behalf of the authors

Response to Editor;

The revised draft is accurate and clear with appropriate responses to the reviewers' comments. The manuscript is considered acceptable after the following corrections are made.

1. There are unnecessary hyphens and superscripts that are not superscripted in some places. (ex. Line 81: 200-m, Line 99: CO₂, Line 100: 17-m, etc.) Please check the entire manuscript including figures and tables.

All unnecessary hyphens are removed from the manuscript. Also I checked superscripts (CO₂) and modified.

2. For Figure 2, add an explanation for the pink shaded curves behind the vertical lines.

The pink shaded curve is a probability distribution function (PDF) of tree height and BDH. We modified Figure 2 caption to make it clear.

“Figure 2. The histograms of DBH and tree height. The pink shaded curves are fitted Probability distribution functions (PDF). (a) DBH in 2010, (b) DBH in 2014, (c) height in 2010, and (d) height in 2014. Dashed blue vertical lines indicate average values. The histograms of DBH and tree height are normalized to 1 to compare with PDF function.”

3rd submission

Editor Start Date: 8/21/2023

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Editorial Office's note

Calculate checksum date: 8/29/2023

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