

Leaf Chlorophyll and Total Carotenoid Content, Barrow, Alaska, 2013-2015

Record_id: NGA132

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Summary:

Chlorophyll a, Chlorophyll b and total carotenoid content were determined on 146 samples collected from Arctic plant species within the Barrow Environmental Observatory in 2013 and 2015. Species sampled are *Arctophila fulva*, *Arctagrostis latifolia*, *Carex aquatilis*, *Dupontia fisheri*, *Eriophorum angustifolium*, *Petasites frigidus*, *Salix pulchra*, *Vaccinium vitis-idaea*, *Salix rotundifolia*, *Luzula arctica* and *Saxifraga punctata*.

Samples collected in vegetation plots and outside vegetation plots over an area of approximate 1 km² centered at 71.275 degrees N, 156.641 degrees W.

Please use this citation to reference the data.

Alistair Rogers, Stefanie Lasota, Kim S. Ely, Shawn P. Serbin, Victoria Sloan, Ingrid Slette, Jennifer Liebig. 2018. Leaf Chlorophyll and Total Carotenoid Content, Barrow, Alaska, 2013-2015. Next Generation Ecosystem Experiments Arctic Data Collection, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tennessee, USA. Dataset accessed on [date] at <https://dx.doi.org/10.5440/1429875>.

Associated Paper

Data Characteristics

- The data file containing analytic results for 146 samples presented as an Excel spreadsheet (*.xlsx) with data description tab and Data tab.
- The data only is also presented as a comma-separated (.csv) file
- Area covered approximately 1 km² centered at 71.275 degrees N, 156.641 degrees W

Data Dictionary

Data Files:

NGEE_Arctic_chlorophyll_and_carotenoids_Barrow_2013_2015.xlsx

NGEE_Arctic_chlorophyll_and_carotenoids_Barrow_2013_2015.csv

column_name	units/format	Description
Sample_ID	alphanumeric	Unique sample identification number
Date	YYYYMMDD	date of sample collection from field site
USDA_Species_Code	alphanumeric	Species identifier, see table below for definitions
Total Leaf Area	m2	Area of leaf material used in pigment extraction (m2)
A470	numeric	Raw absorbance of chlorophyll extract at 470 nm
A652	numeric	Raw absorbance of chlorophyll extract at 652 nm
A665	numeric	Raw absorbance of chlorophyll extract at 665 nm
A750	numeric	Raw absorbance of chlorophyll extract at 750 nm
A470bc	numeric	Blank corrected absorbance of chlorophyll extract at 470 nm
A652bc	numeric	Blank corrected absorbance of chlorophyll extract at 652 nm
A665bc	numeric	Blank corrected absorbance of chlorophyll extract at 665 nm
Chl_a_L	µg ml extract-1	Chlorophyll a concentration (µg ml extract-1) estimated using the extinction coefficients and equations of Lichtenthaler (1987)
Chl_b_L	µg ml extract-1	Chlorophyll b concentration (µg ml extract-1) estimated using the extinction coefficients and equations of Lichtenthaler (1987)
Carot_tot_L	µg ml extract-1	Total carotenoid concentration (µg ml extract-1) estimated using the extinction coefficients and equations of Lichtenthaler (1987)
Chl_a_area_L	mg m-2 leaf area	Chlorophyll a content (mg m-2 leaf area) estimated with the extinction coefficients and equations of Lichtenthaler (1987)
Chl_b_area_L	mg m-2 leaf area	Chlorophyll b content (mg m-2 leaf area) estimated with the extinction coefficients and equations of Lichtenthaler (1987)
Chl_ab_area_L	mg m-2 leaf area	Total chlorophyll content (mg m-2 leaf area) estimated with the extinction coefficients and equations of Lichtenthaler (1987)

column_name	units/format	Description
Chl_a_b_ratio_L	numeric	Chlorophyll a:b ratio, estimated with the extinction coefficients and equations of Lichtenthaler(1987)
Carot_tot_area_L	mg m-2 leaf area	Total carotenoid content (mg m-2 leaf area) estimated with the extinction coefficients and equations of Lichtenthaler (1987)
Chl_a_P	µg ml extract-1	Chlorophyll a concentration (µg ml extract-1) estimated using the extinction coefficients and equations of Porra et al (1989)
Chl_b_P	µg ml extract-1	Chlorophyll b concentration (µg ml extract-1) estimated using the extinction coefficients and equations of Porra et al (1989)
Chl_a_area_P	mg m-2 leaf area	Chlorophyll a content (mg m-2 leaf area) estimated using the extinction coefficients and equations of Porra et al (1989)
Chl_b_area_P	mg m-2 leaf area	Chlorophyll b content (mg m-2 leaf area) estimated using the extinction coefficients and equations of Porra et al (1989)
Chl_ab_area_P	mg m-2 leaf area	Total chlorophyll content (mg m-2 leaf area) estimated using the extinction coefficients and equations of Porra et al (1989)
Chl_a_b_ratio_P	numeric	Chlorophyll a:b ratio, estimated with the extinction coefficients and equations of Porra et al (1989)
Chl_a_mol_P	nmol mL extract -1	Chlorophyll a concentration (nmol mL extract -1) estimated using the molar extinction coefficients and equations of Porra et al (1989)
Chl_b_mol_P	nmol mL extract -1	Chlorophyll b concentration (nmol mL extract-1) estimated using the molar extinction coefficients and equations of Porra et al (1989)
Chl_a_mol_area_P	µmol m-2 leaf area	Chlorophyll a content (µmol m-2 leaf area) estimated using the molar extinction coefficients and equations of Porra et al (1989)
Chl_b_mol_area_P	µmol m-2 leaf area	Chlorophyll b content (µmol m-2 leaf area) estimated using the molar extinction coefficients and equations of Porra et al (1989)
Chl_ab_mol_area_P	µmol m-2 leaf area	Total chlorophyll content (µmol m-2 leaf area) estimated using the molar extinction coefficients and equations of Porra et al (1989)

column_name	units/format	Description
Chl a_b_ratio_P	numeric	Chlorophyll a:b ratio, estimated with the extinction coefficients and equations of Porra et al (1989)

Example Data Records:

Sample_ID,Date,USDA_Species_Code,Total_Leaf_Area,A470,A652,A665,A750,A470bc,A652bc,A665bc,Chl_a_L,Chl_b_L,Carot_tot_L,Chl_a_area_L,Chl_b_area_L,Chl_ab_area_L,Chl_a_b_ratio_L,Carot_tot_area_L,Chl_a_P,Chl_b_P,Chl_a_area_P,Chl_b_area_P,Chl_ab_area_P,Chl_a_b_ratio_P,Chl_a_mol_P,Chl_b_mol_P,Chl_a_mol_area_P,Chl_b_mol_area_P,Chl_ab_mol_area_P,Chl_a_b_ratio_mol_P
alphanumeric,YYYYMMDD,alphanumeric,m^2,numeric,numeric,numeric,numeric,numeric,numeric,numeric,micro g ml extract-1,micro g ml extract-1,micro g ml extract-1,mg m-2 leaf area,mg m-2 leaf area,mg m-2 leaf area,numeric,mg m-2 leaf area,micro g ml extract-1,micro g ml extract-1,mg m-2 leaf area,mg m-2 leaf area,numeric,nmol mL extract -1 ,nmol mL extract -1 ,micro mol m-2 leaf area,micro mol m-2 leaf area,micro mol m-2 leaf area,numeric
BNL1263,20130724,ARFU2,0.000945,-9999,0.285,0.517,0.004,-9999,0.281,0.513,6.00,1.74,-9999,318,92,410,3.45,-9999,5.96,1.65,315,87,402,3.61,6.66,1.82,353,96,449,3.67
BNL1265,20130724,ARFU2,0.0009,-9999,0.26,0.469,0,-9999,0.26,0.469,5.46,1.70,-9999,303,94,398,3.22,-9999,5.42,1.60,301,89,390,3.38,6.06,1.77,337,98,435,3.43

Data Acquisition Materials and Methods

Chlorophyll a, Chlorophyll b and total carotenoid content were determined as described previously (Porra et al. 1989; Lichtenthaler et al 1987). For each species, total leaf area was determined for 6-10 replicate samples using a ruler and hand lens or cork borer. To enable timely release of chlorophyll, leaf material was diced and placed immediately into centrifuge tubes containing 40 ml of ice cold methanol ($\geq 99.8\%$, Sigma-Aldrich Co. LLC, St. Louis, MO). Centrifuge tubes were kept in the dark, at 4°C to avoid chlorophyll degradation and monitored until full release of chlorophyll from the leaf tissue (6-48h). Extract volume was made up to 50 ml in a volumetric flask. 1 ml of chlorophyll extract was transferred to a plastic cuvette and absorbance was measured at 750, 665, 652 and $470 \text{ nm} \pm 2 \text{ nm}$ (Spectral bypass 5 nm, Cole Parmer 1200 Spectrophotometer, Cole Parmer Instruments Company, Vernon Hills, IL). Chlorophyll content was determined using the extinction coefficients of Porra et al (1989) and Lichtenthaler et al (1987). In 2013 no data were collected at 470 nm. Data users can use either Lichtenthaler (1987) or Porra et al (1989) derived chlorophyll content but when using carotenoids data in combination with chlorophyll data should use Lichtenthaler (1987) derived values. Additional leaf material was taken from the same samples, dried to constant mass (70°C) and used to determine leaf mass area (g m^{-2}) and elemental carbon and nitrogen content. Leaf N content and LMA data with matching sample ID numbers are publicly available (Rogers et al 2017).

References

Alistair Rogers, Kim S. Ely, Shawn P. Serbin, Stefanie Lasota and Wil Lieberman-Cribbin. 2017. Leaf Mass Area, Leaf Carbon and Nitrogen Content, Barrow, Alaska, 2012-2016. Next Generation Ecosystem Experiments Arctic Data Collection, Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. Accessed at <https://dx.doi.org/10.5440/1336812>.

Sloan VL, Brooks JD, Wood SJ, Liebig JA, Siegrist J, Iversen CM, Norby RJ. 2014. Plant community composition and vegetation height, Barrow, Alaska, Ver. 1. Next Generation Ecosystem Experiments Arctic Data Collection, Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. Data set accessed at <https://dx.doi.org/10.5440/1129476>.

Data Access:

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