Supplementary

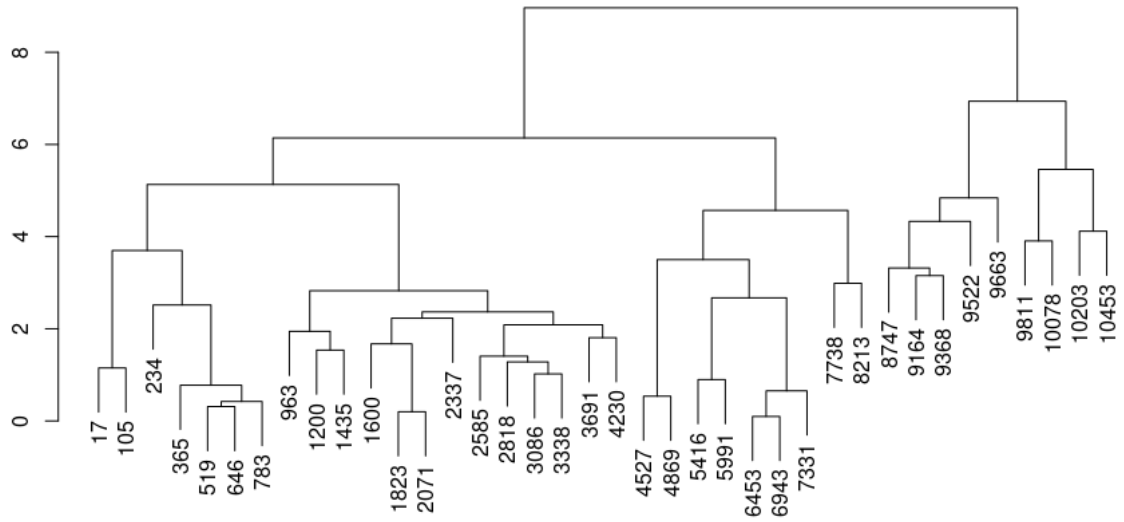


Figure S1. CONISS clustering based on proportions of PCR replicates. Sample ages are displayed on the labels of leaves.

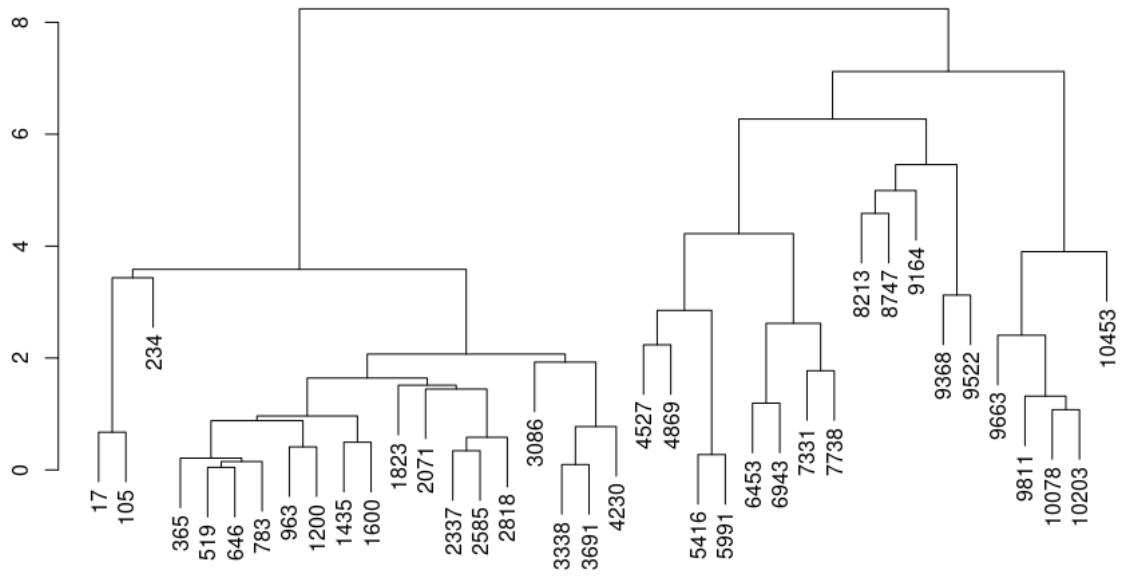
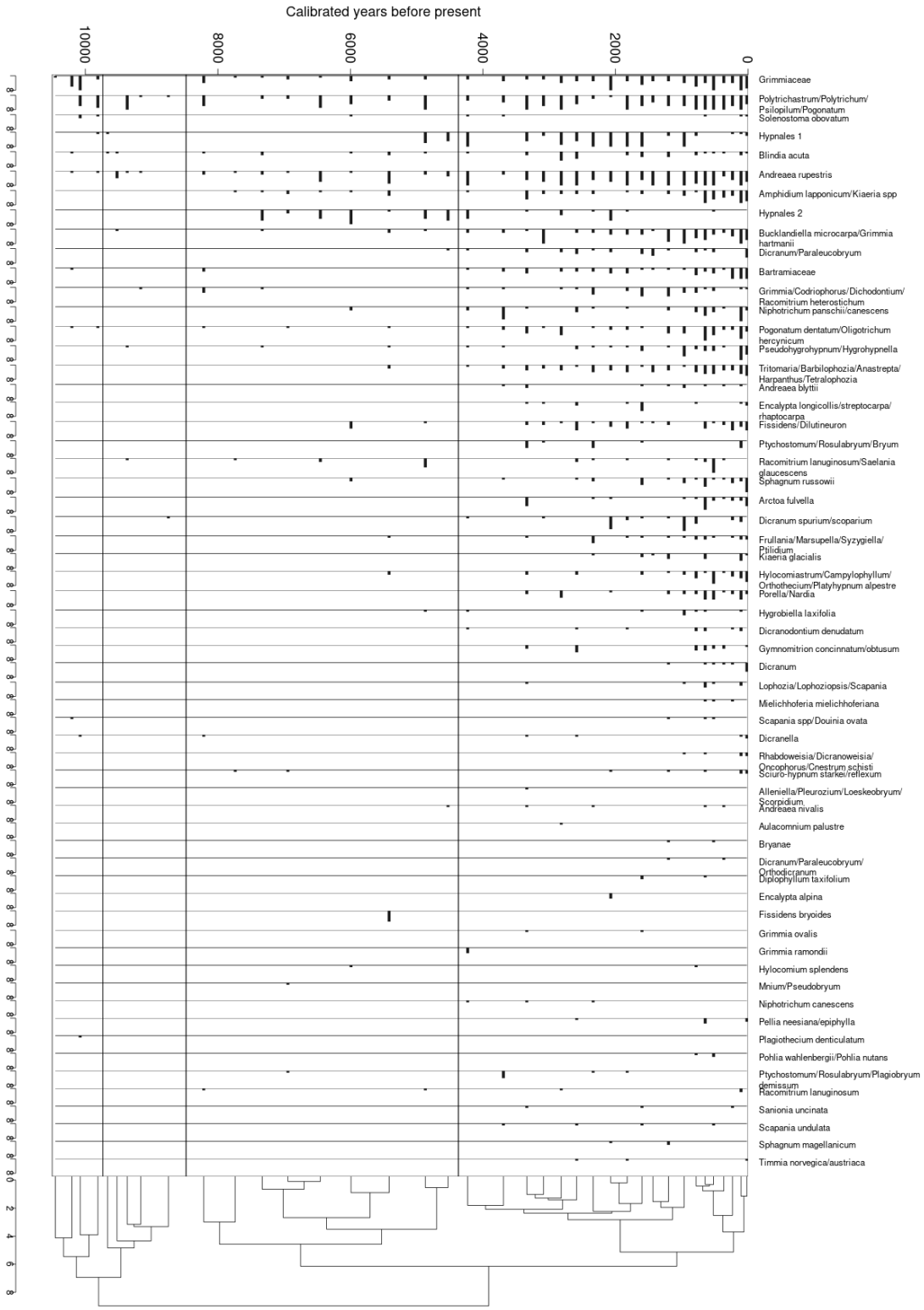
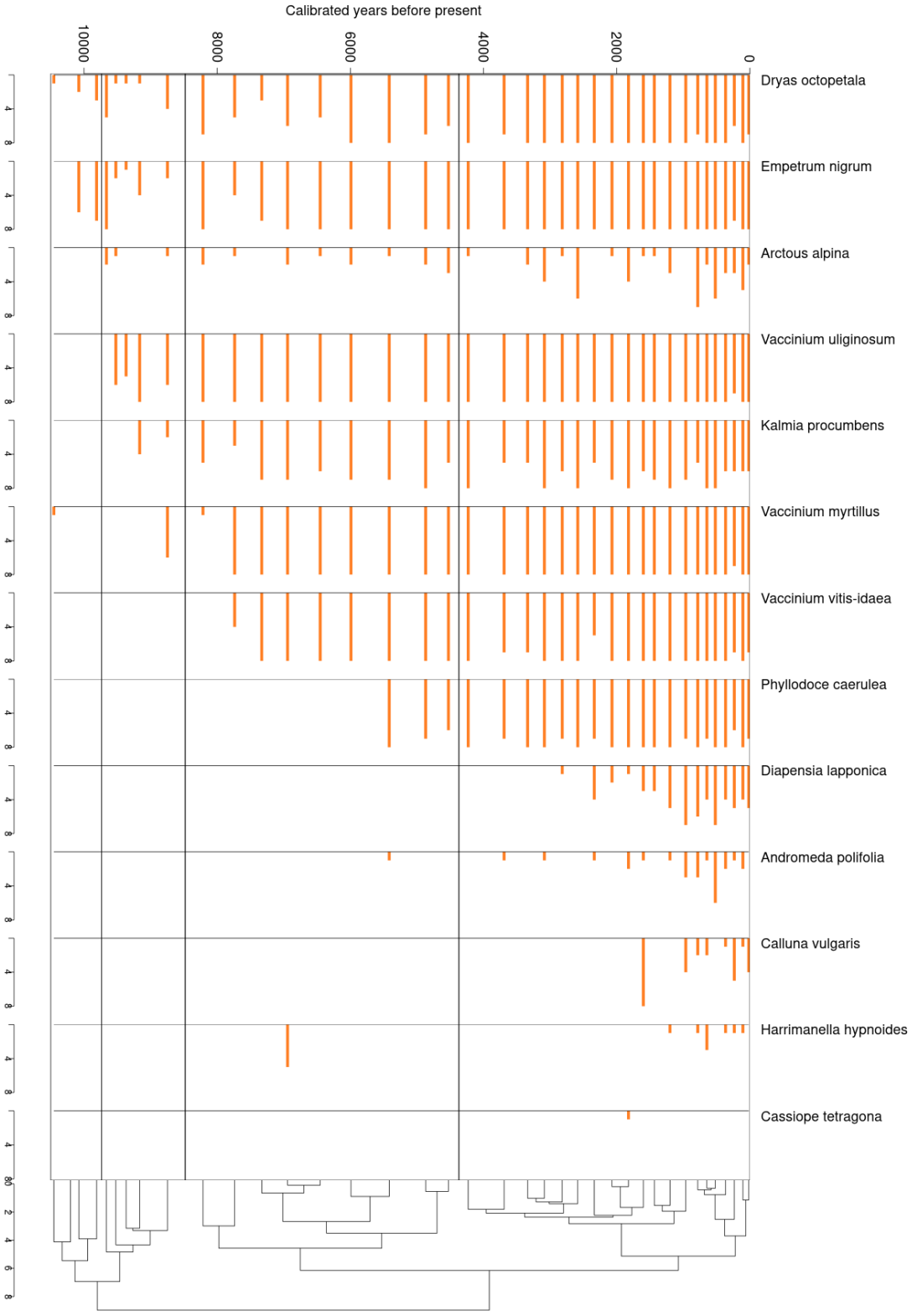


Figure S2. CONISS clustering based on proportions of total filtered reads. Sample ages are displayed on the labels of leaves.

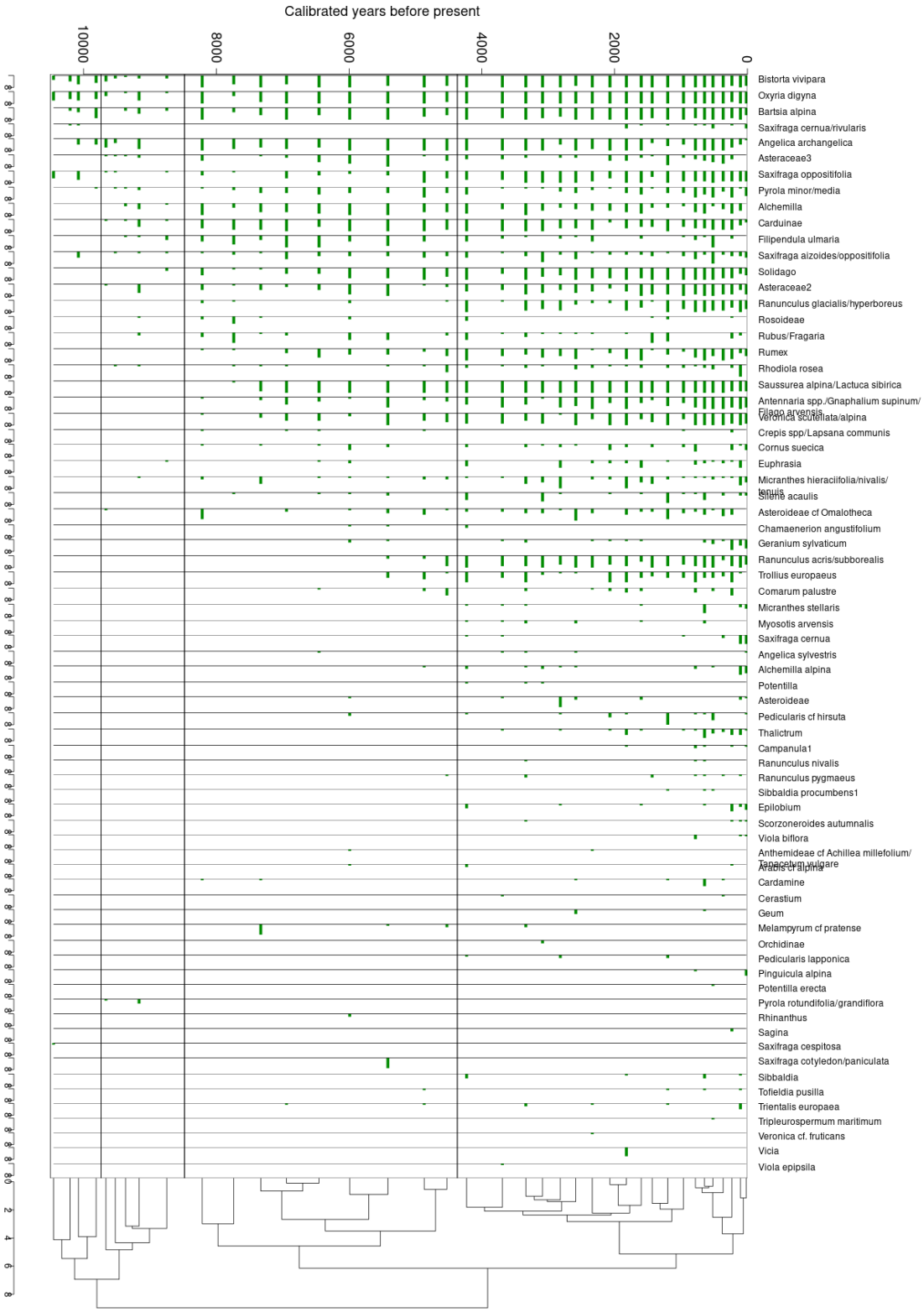
Bryophytes


Calibrated years before present
10000
8000
6000
4000
2000
0
Grimmiaceae
Polytrichastrum/Polytrichum/ Psilopilum/Pogonatum
Solenostoma obovatum
Hypnales 1
Blindia acuta
Andreaea rupestris
Amphidium lapponicum/Kiaeria spp
Hypnales 2
Bucklandiella microcarpa/Grimmia hartmanii
Dicranum/Paraleucobryum
Bartramiaceae
Grimmia/Codriophorus/Dichodontium/ Racomitrium heterostichum
Niphotrichum panschii/canescens
Pogonatum dentatum/Oligotrichum hercynicum
Pseudohygrohypnum/Hygrohypnella
Tritomaria/Barbilophozia/Anastrepta/ Harpanthus/Tetralophozia
Andreaea blyttii
Encalypta longicollis/streptocarpa/ rhaptocarpa
Fissidens/Dilutineuron
Ptychostomum/Rosulabryum/Bryum
Racomitrium lanuginosum/Saelania glaucescens
Sphagnum russowii
Arctoa fulvella
Dicranum spurium/scoparium
Frullania/Marsupella/Syzygiella/ Ptilidium
Kiaeria glacialis
Hylocomiastrum/Campylophyllum/ Orthothecium/Platyhypnum alpestre
Porella/Nardia
Hygrobiella laxifolia
Dicranodontium denudatum
Gymnomitrion concinnatum/obtusum
Dicranum
Lophozia/Lophoziopsis/Scapania
Mielichhoferia mielichhoferiana
Scapania spp/Douinia ovata
Dicranella
Rhabdoweisia/Dicranoweisia/ Oncophorus/Cnestrum schisti
Sciuro-hypnum starkei/reflexum
Alleniella/Pleurozium/Loeskeobryum/ Scorpidium
Andreaea nivalis
Aulacomnium palustre
Bryanae
Dicranum/Paraleucobryum/ Orthodicranum
Diplophyllum taxifolium
Encalypta alpina
Fissidens bryoides
Grimmia ovalis
Grimmia ramondii
Hylocomium splendens
Mnium/Pseudobryum
Niphotrichum canescens
Pellia neesiana/epiphylla
Plagiothecium denticulatum
Pohlia wahlenbergii/Pohlia nutans
Ptychostomum/Rosulabryum/Plagiobryum demissum
Racomitrium lanuginosum
Sanionia uncinata
Scapania undulata
Sphagnum magellanicum
Timmia norvegica/austriaca

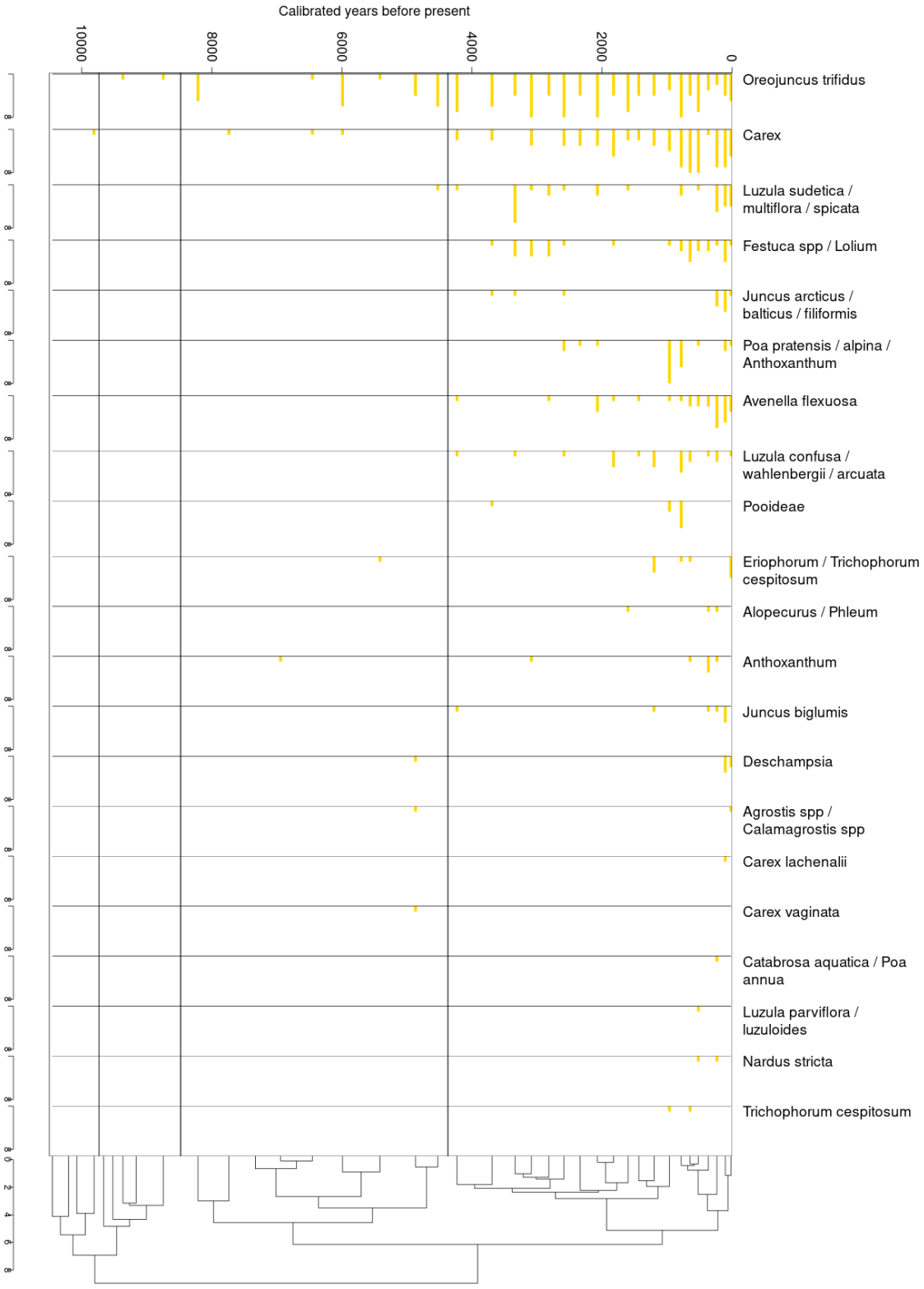

Calibrated years before present
10000
8000
6000
4000
2000
0
Dryas octopetala
Empetrum nigrum
Arctous alpina
Vaccinium uliginosum
Kalmia procumbens
Vaccinium myrtillus
Vaccinium vitis-idaea
Phyllodoce caerulea
Diapensia lapponica
Andromeda polifolia
Calluna vulgaris
Harrimanella hypnoides
Cassiope tetragona

Vascular cryptogams

Forbs


Calibrated years before present
10000
8000
6000
4000
2000
0
Bistorta vivipara
Oxyria digyna
Bartsia alpina
Saxifraga cernua/rivularis
Angelica archangelica
Asteraceae3
Saxifraga oppositifolia
Pyrola minor/media
Alchemilla
Carduinae
Filipendula ulmaria
Saxifraga aizoides/oppositifolia
Solidago
Asteraceae2
Ranunculus glacialis/hyperboreus
Rosoideae
Rubus/Fragaria
Rumex
Rhodiola rosea
Saussurea alpina/Lactuca sibirica
Antennaria spp./Gnaphalium supinum/
Filago arvensis
Veronica scutellata/alpina
Crepis spp/Lapsana communis
Cornus suecica
Euphrasia
Micranthes hieraciifolia/nivalis/
tenuis
Silene acaulis
Asteroideae cf Omalotheca
Chamaenerion angustifolium
Geranium sylvaticum
Ranunculus acris/subborealis
Trollius europaeus
Comarum palustre
Micranthes stellaris
Myosotis arvensis
Saxifraga cernua
Angelica sylvestris
Alchemilla alpina
Potentilla
Asteroideae
Pedicularis cf hirsuta
Thalictrum
Campanula1
Ranunculus nivalis
Ranunculus pygmaeus
Sibbaldia procumbens1
Epilobium
Scorzoneroides autumnalis
Viola biflora
Anthemideae cf Achillea millefolium/
Tanacetum vulgare
Arabis cf alpina
Cardamine
Cerastium
Geum
Melampyrum cf pratense
Orchidinae
Pedicularis lapponica
Pinguicula alpina
Potentilla erecta
Pyrola rotundifolia/grandiflora
Rhinanthus
Sagina
Saxifraga cespitosa
Saxifraga cotyledon/paniculata
Sibbaldia
Tofieldia pusilla
Trientalis europaea
Tripleurospermum maritimum
Veronica cf. fruticans
Vicia
Viola epipsila

Graminoids


Calibrated years before present
10000
8000
6000
4000
2000
0
Oreojuncus trifidus
Carex
Luzula sudetica / multiflora / spicata
Festuca spp / Lolium
Juncus arcticus / balticus / filiformis
Poa pratensis / alpina / Anthoxanthum
Avenella flexuosa
Luzula confusa / wahlenbergii / arcuata
Pooideae
Eriophorum / Trichophorum cespitosum
Alopecurus / Phleum
Anthoxanthum
Juncus biglumis
Deschampsia
Agrostis spp / Calamagrostis spp
Carex lachenalii
Carex vaginata
Catabrosa aquatica / Poa annua
Luzula parviflora / luzuloides
Nardus stricta
Trichophorum cespitosum

Trees

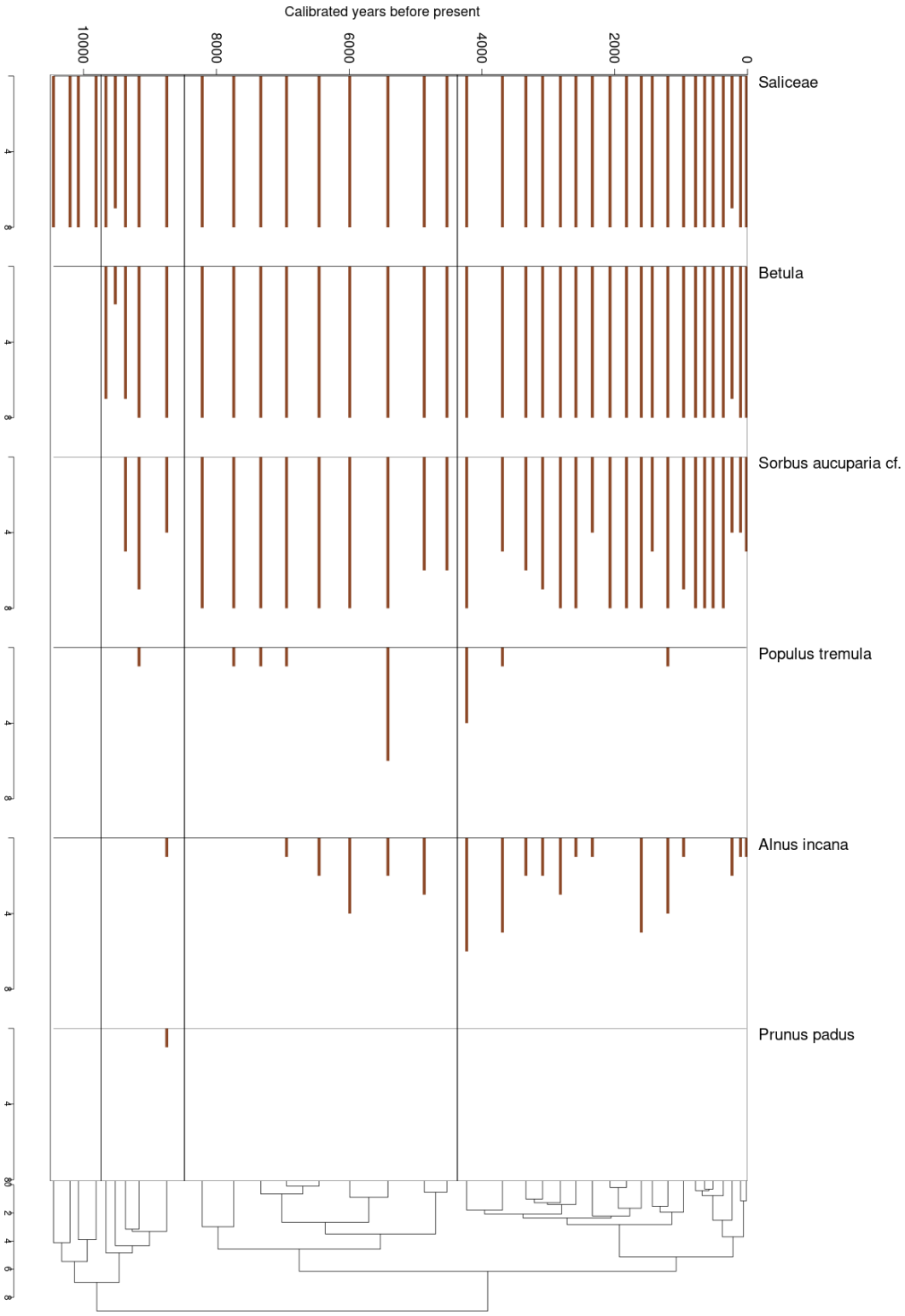

Calibrated years before present
10000
8000
6000
4000
2000
0
Saliceae
Betula
Sorbus aucuparia cf.
Populus tremula
Alnus incana
Prunus padus

Figure S3. Number of PCR replicates each species appears in separated by functional group. CONISS boundaries are indicated by vertical lines and clustsering is present at the bottom of the figure.

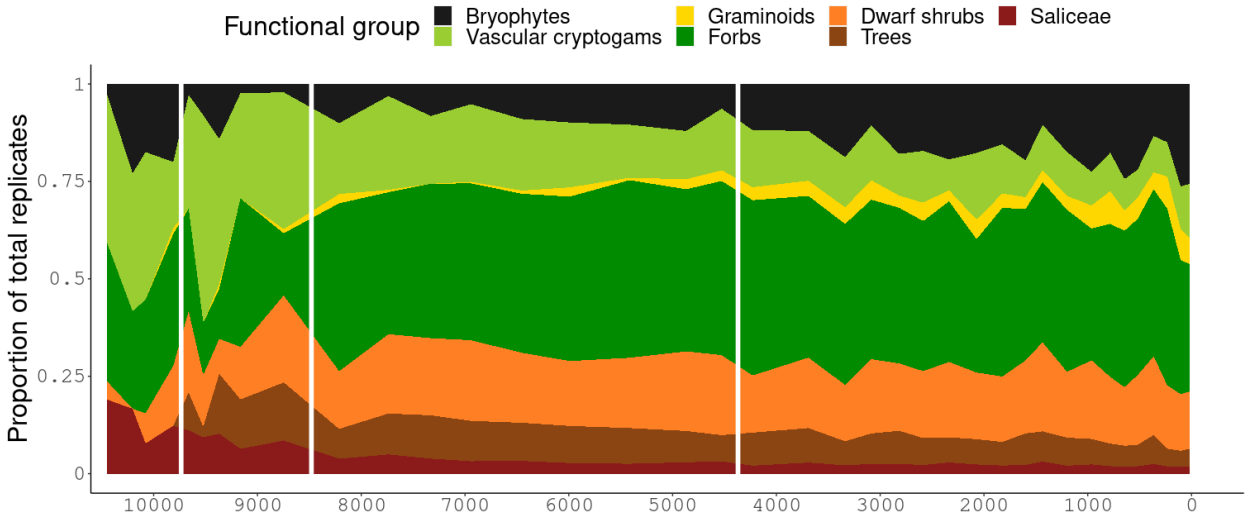
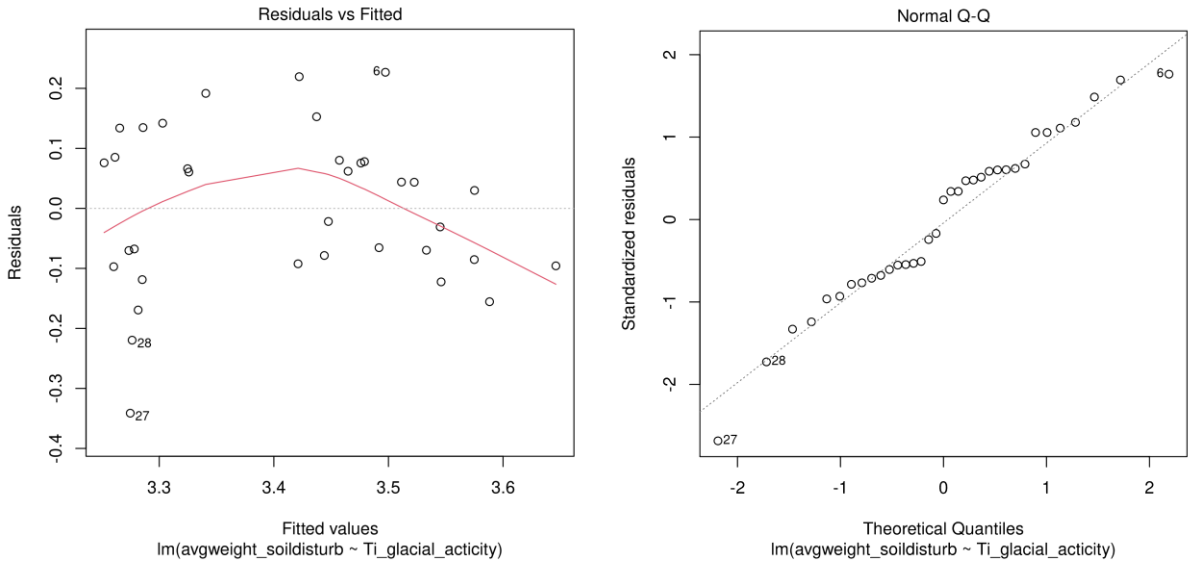
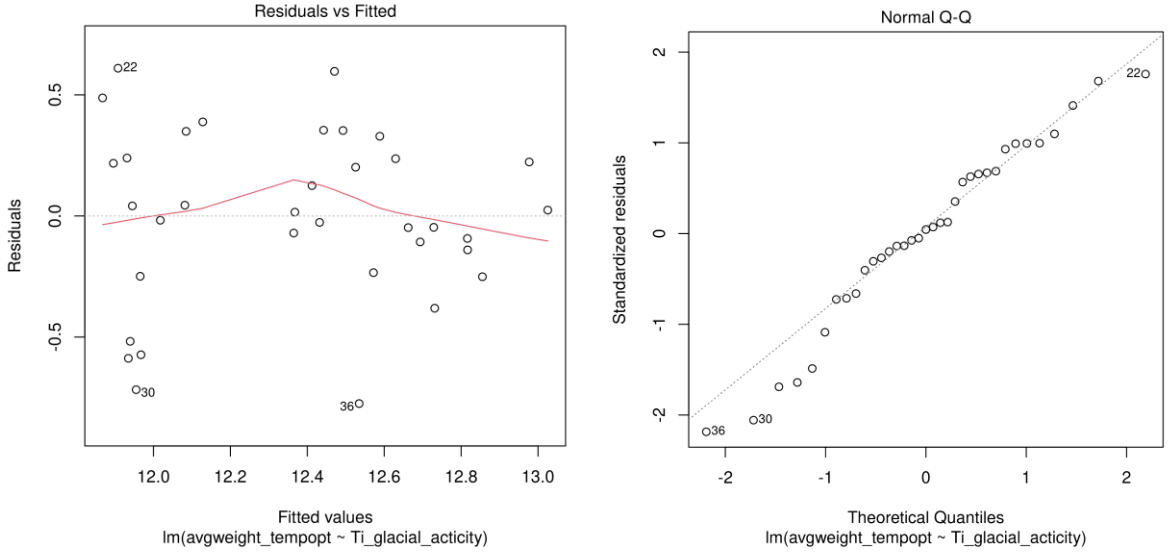


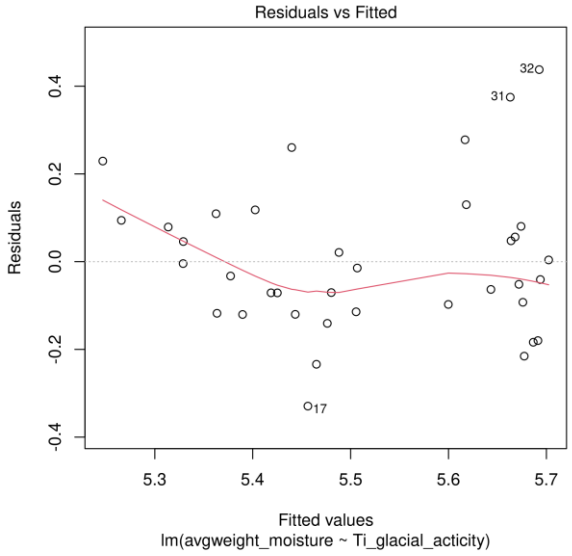
Figure S4. Proportion of PCR replicates based on functional groups. Vegetation zone boundaries based on CONISS analyses are demarcated with vertical white bars.

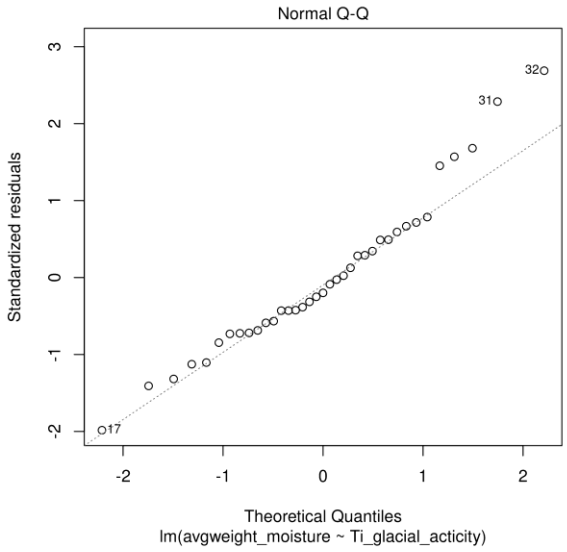
S5. Linear Regression diagnostic plots



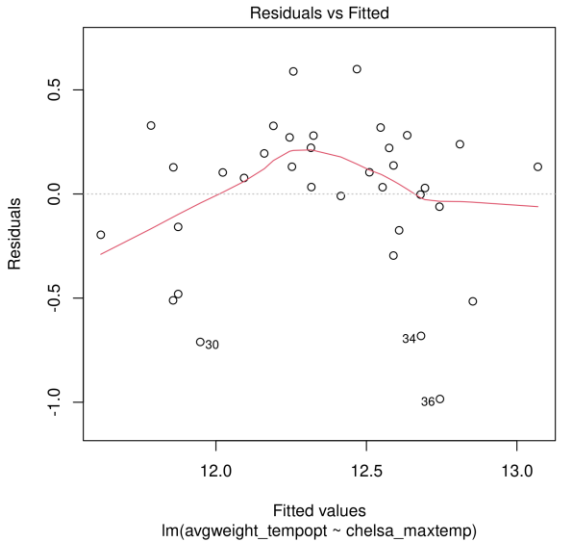
Diagnostic plots of the linear model fit between **soil disturbance trait value** and **glacial activity**.

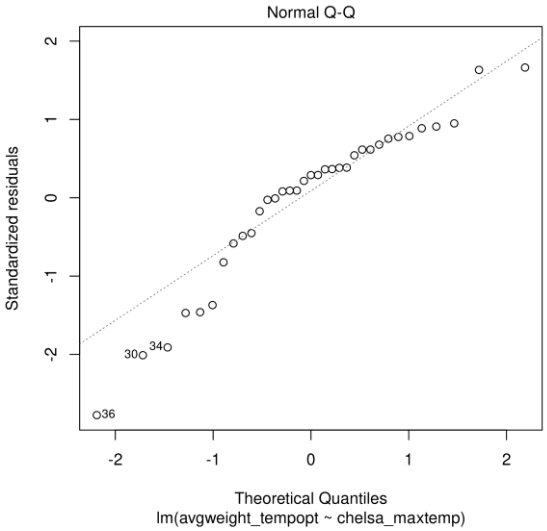




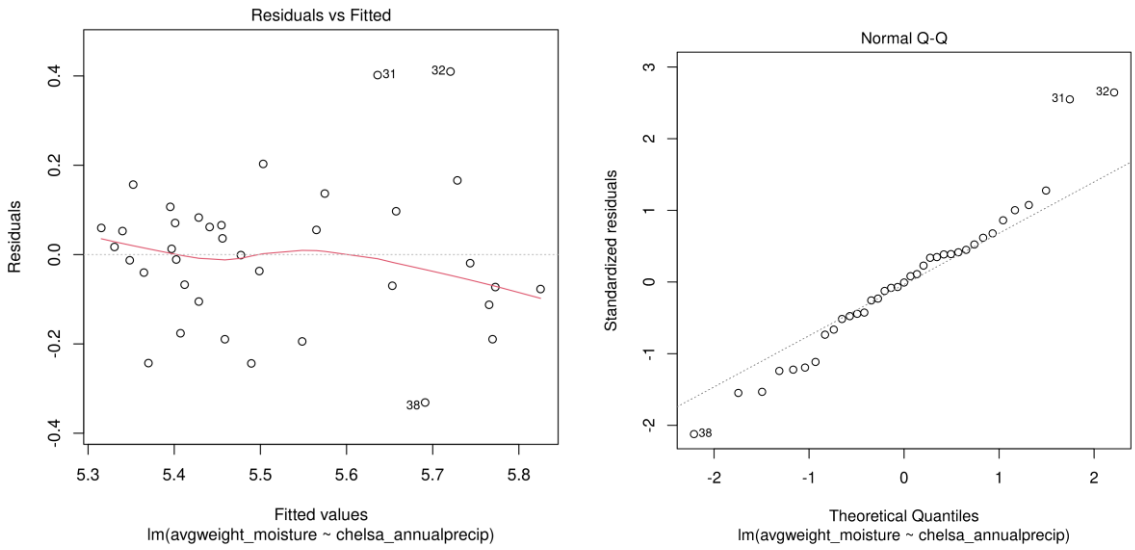


Daignostic plots of the linear model fit between **moisture trait value** and **glacial activity**





Diagnostic plots of the linear model fit between **temperature optimum trait value** and **CHELSA-TraCE21k mean temperature of warmest quarter (bio10).**



Diagnostic plots of the linear model fit between **moisture trait value** and **CHELSA-TraCE21k annual precipitation (bio12).**

Figure S5. Diagnostic plots for linear regressions.