Climate changes in interior semi-arid Spain from the last interglacial to the late Holocene

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The supplementary information contains the following Figures and Tables:

SI Figure 1. The impact of removing Poaceae and Polypodiales from the taxon set on reconstructions of (a) mean temperature of the coldest month (MTCO, °C) and (b) growing degree days above a base level of 0° C (GDD_0) during MIS4 and MIS5a. The red line (without P/P) is the reconstructed values once Poaceae and Polypodiales are removed. The comparison shows that removing these two taxa reduces anomalous peaks, where they were particularly abundant, but has little impact on the reconstructions for the rest of the samples.

SI Figure 2. Reconstructed mean temperature of the coldest month (MTCO, °C), growing degree days above a base level of 0°C (GDD_0) and moisture index (the ratio of annual precipitation to annual potential evapotranspiration, MI). This plot differs from Figure 4 in the main text because the reconstructions for all of the samples are shown. The Marine Isotope Stages (MIS) and substages are shown by vertical dotted lines and labeled; we also show the transition interval between MIS6 and MIS5e. Red dots indicate the modern climate calculated from the elevation-corrected climate data from the Climate Research Unit (CRU) 2.0 data set.

SI Figure 3: Changes in [CO_2] and their impact of reconstructed moisture index (the ratio of annual precipitation to annual potential evapotranspiration, MI). The upper panel shows the changes in [CO_2], with a loess smoothing with a span of 0.1, and the lower panel shows reconstructed MI with (red line) and without (blue line) taking account of the [CO_2] correction.

SI Figure 4: Identification of reconstructed climate changes during selected Dansgaard-Oeschger and Heinrich events. Reconstructed mean temperature of the coldest month (MTCO, °C), growing degree days above a base level of 0° C (GDD_0) and moisture index (the ratio of annual precipitation to annual potential evapotranspiration, MI). Only samples with a Hill's N2 biodiversity index >2 are plotted. The Marine Isotope Stages (MIS) and substages are shown by vertical dotted lines and labeled; we also show the transition interval between MIS6 and MIS5e. Red dots indicate the modern climate calculated from the elevation-corrected climate data from the Climate Research Unit (CRU) 2.0 data set.

SI Table 1: Modern pollen surface samples from north, northeastern and eastern Spain included in the modern pollen data set, after taxonomic standardization and amalgamation.
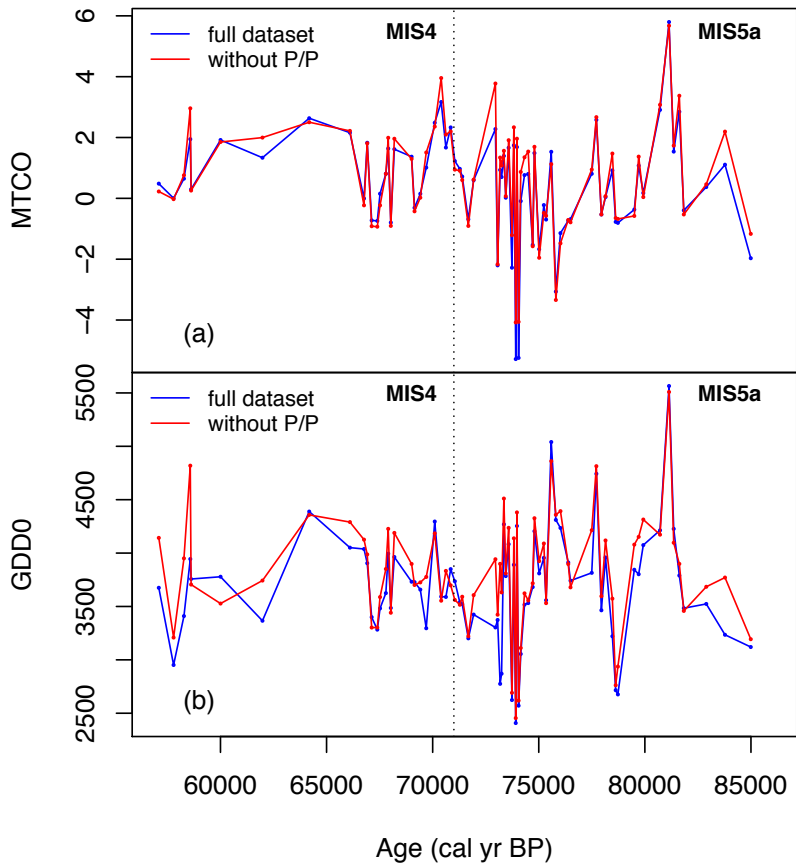
SI Table 2: Allocation of pollen taxa in the modern data set to the amalgamated taxa used in the reconstructions. Note that this includes all of the 249 amalgamated taxa; some of these taxa were not used in WA-PLS because they occurred in less than 10 sites in the modern training data set.

SI Table 3: The results of randomisation *t*-test on the leave-one-out cross-validated predictions of the weighted averaging-partial least squares (WA-PLS) regression models for 196 taxa (including Poaceae and Polypodiales). Selected components are marked in bold.
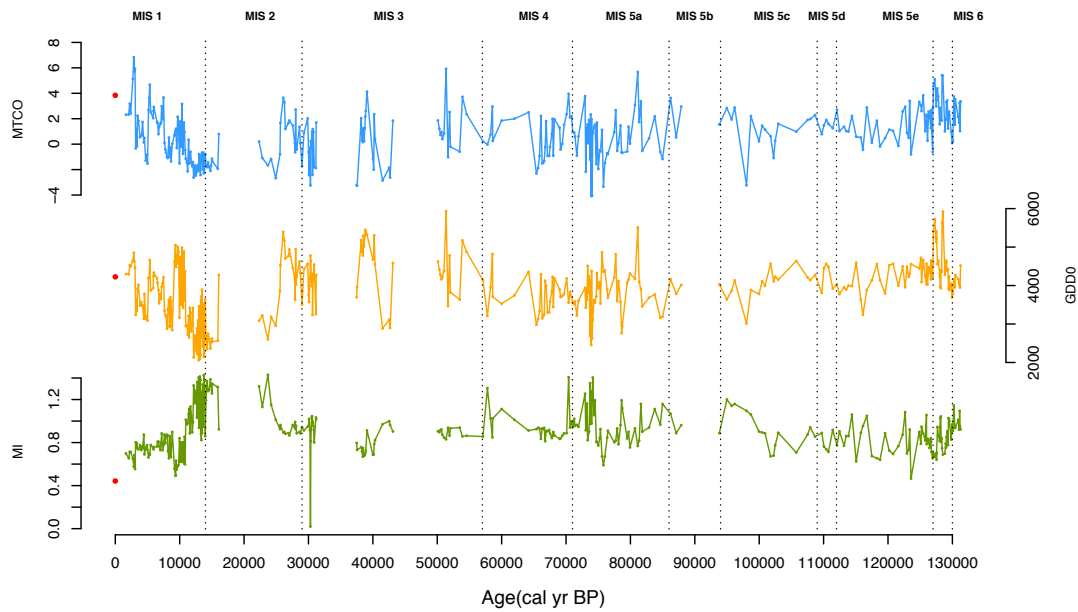
SI Table 4: Reconstructed mean temperature of the coldest month (MTCO, °C), growing degree days above a base level of 0°C (GDD_0) and moisture index (the ratio of annual precipitation to annual potential evapotranspiration, MI) for each of the samples. We give the depth and age for each sample. For the reconstructions of MI, we give values before and after the [CO_2] correction.

SI Table 5: Definition of the Marine Isotope Stages (and sub-stages) boundaries used in our analyses.
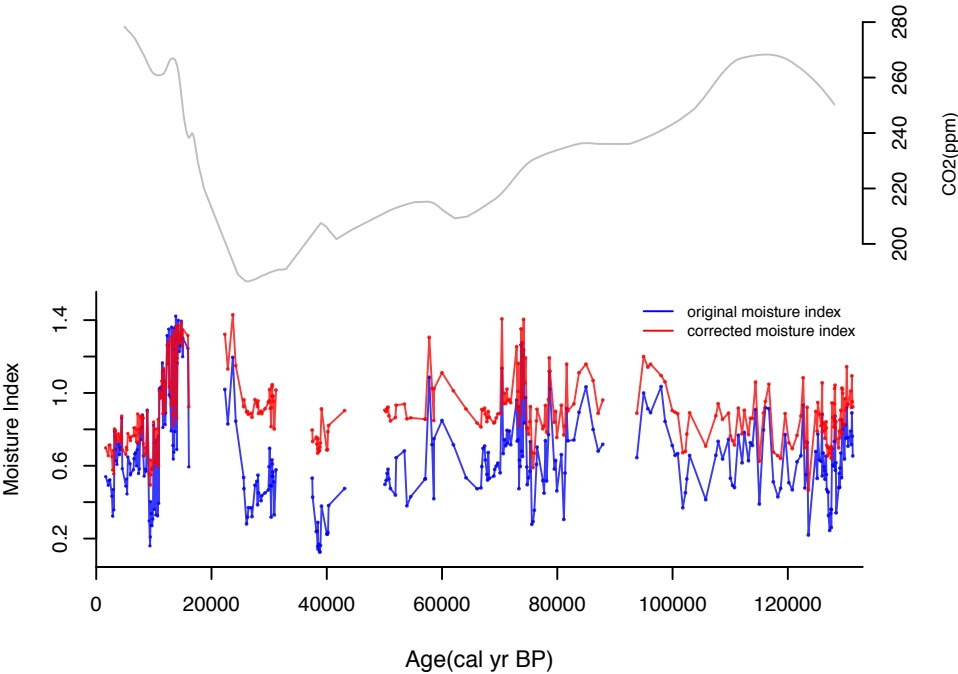
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1065   reconstructions for the rest of the samples.
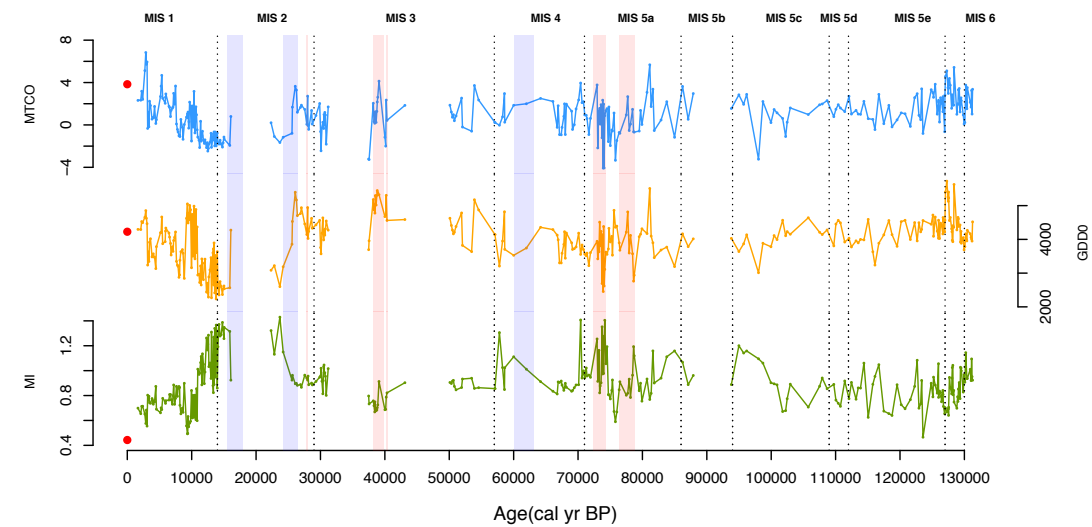1066

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1103 (provided as separate csv file)
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Amalgamated taxon	Pollen taxa included
Abies	*Abies, Abies alba, Abies cilicica, Abies nordmanniana, Abies pinsapo* subsp *marocana*
Acanthaceae	*Acanthus mollis*
Acer	*Acer, Acer campestre, Acer campestre* type*, Acer pseudoplatanus, Acer* type
Aconitum	*Aconitum, Aconitum napellus* type*, Aconitum septentrionale, Aconitum* type
Adonis	*Adonis, Adonis aestivalis* type*, Adonis* type*, Adonis vernalis*
Adoxaceae	*Adoxa, Adoxa moschatellina*
Aesculus	*Aesculus, Aesculus hippocastanum*
Ailanthus	*Ailanthus*
Aizoaceae	*Carpobrotus*
Alnus	*Alnus, Alnus alnobetula* subsp *fruticosa, Alnus glutinosa, Alnus glutinosa* type*, Alnus glutinosa/Alnus incana, Alnus incana, Alnus incana* type*, Alnus incana/Alnus cordata* type*, Alnus non-viridis, Alnus* type
Alnus viridis	*Alnus viridis, Alnus viridis* subsp *fruticosa*
Amaranthaceae	*Aellenia* type, Amaranthaceae, *Amaranthus, Atriplex nudicaulis, Chenopodium, Chenopodium album, Noaea* type*, Nonea, Spinacia* type
Amaryllidaceae	Amaryllidaceae*, Narcissus*
Amygdaloideae	Amygdaloideae*, Sorbus/Cotoneaster*
Anacardiaceae	Anacardiaceae
Andromeda	*Andromeda*
Anemone	*Anemone, Anemone nemorosa, Anemone nemorosa* type*, Anemone nemorosa* type*/Hepatica nobilis, Anemone nemorosa/Anemone ranunculoides, Anemone* type

Apiaceae	*Aegopodium, Aegopodium podagraria, Ammi* type, *Angelica, Angelica archangelica, Angelica* type, *Anisosciadium* type, *Anthriscus, Anthriscus sylvestris, Anthriscus sylvestris* type, *Anthriscus* type, Apiaceae, *Apium* type, *Apium/Berula, Astrantia, Astrantia* type, *Athamanta cretensis, Berula erecta* type, *Bunium* type, *Bupleurum, Bupleurum* type, *Carum carvi, Chaerophyllum, Chaerophyllum hirsutum* type, *Chaerophyllum* type, *Conopodium, Conopodium majus,* Daucaceae, *Daucus carota, Daucus carota* type, *Daucus* type, *Echinophora, Echinophora* type, *Eryngium, Eryngium ilicifolium, Eryngium* type, *Falcaria* type, *Ferula* type, *Heracleum, Heracleum laciniatum* type, *Heracleum sphondylium, Heracleum* type, *Laserpitium latifolium* type, *Laserpitium prutenicum, Ligusticum mutellina, Malabaila, Meum, Meum athamanticum, Neogaya simplex* type, *Oenanthe, Oenanthe* type, *Orlaya, Orlaya grandiflora, Pastinaca* type, *Peucedanum, Peucedanum ostruthium, Peucedanum* type, *Pimpinella, Pimpinella major* type, *Pimpinella* type, *Pleurospermum austriacum, Sanicula, Sanicula europaea, Sanicula* type, *Scandix, Seseli* type, *Smyrnium* type, *Torilis, Torilis arvensis, Torilis* type, *Turgenia* type
Aquilegia	*Aquilegia* type
Araceae	Araceae
Arbutus	*Arbutus, Arbutus* type, *Arbutus unedo*
Arctostaphylos	*Arctostaphylos, Arctostaphylos uva-ursi*
Argania	*Argania spinosa*
Aristolochiaceae	*Aristolochia*
Artemisia	*Artemisia, Artemisia genipii/Artemisia mutellina, Artemisia herba-alba* type, *Artemisia* type, *Artemisia vulgaris* type
Asclepiadaceae	Asclepiadaceae
Asparagaceae	Asparagaceae, *Asparagus, Asparagus* type, *Convallaria, Maianthemum, Maianthemum bifolium, Maianthemum* type, *Muscari, Ornithogalum* type, *Polygonatum, Scilla* type
Asphodelaceae	*Eremurus*
Asteraceae	Asteraceae
Asteraceae (Liguliflorae)	Asteraceae (Liguliflorae)

Asteroideae	*Achillea, Achillea* type, *Achillea/Anthemis* type, *Achillea/Aster, Achillea/Aster* type, *Adenostyles* type, *Ambrosia, Ambrosia artemisiifolia* type, *Ambrosia* type, *Ambrosia/Xanthium, Antennaria, Antennaria* type, *Anthemis, Anthemis* type, *Arnica montana, Aster, Aster bellidiastrum, Aster* type, *Asteroideae, Bellis, Bellis* type, *Bidens, Bidens* type, *Calendula, Calendula* type, *Chrysanthemum alpinum, Doronicum, Erigeron, Eupatorium, Eupatorium* type, *Evax, Filago* type, *Gnaphalium, Gnaphalium* type, *Helianthus, Helianthus* type, *Homogyne, Homogyne alpina, Inula, Inula* type, *Matricaria* type, *Petasites, Petasites* type, *Senecio, Senecio* type, *Solidago, Solidago* type, *Solidago virgaurea* type, *Tussilago farfara, Tussilago* type, *Xanthium, Xanthium spinosum, Xanthium spinosum* type, *Xanthium strumarium, Xanthium* type
Astragalus	*Astragalus, Astragalus alpinus* type, *Astragalus* type
Berberidaceae	Berberidaceae, *Leontice leontopetalum*
Berberis	*Berberis, Berberis, Berberis vulgaris*
Betula	*Betula, Betula alba, Betula alba* type, *Betula pendula, Betula pendula/Betula pubescens, Betula pubescens, Betula pubescens* type, *Betula sect. albae, Betula tortuosa, Betula* type
Betula (Chamaebetula)	*Betula fruticosa, Betula humilis, Betula humilis/Betula nana, Betula nana, Betula nana* type, *Betula sect. fruticosae, Betula sect. nanae*
Boraginaceae	*Alkanna, Alkanna* type, *Anchusa, Anchusa arvensis, Anchusa* type, *Arnebia* type, Boraginaceae, *Borago officinalis, Cerinthe, Cerinthe minor, Cerinthe* type, *Cynoglossum creticum, Echium, Echium* type, *Echium vulgare, Heliotropium, Heliotropium* type, *Lithospermum, Lithospermum officinale* type, *Myosotis, Myosotis arvensis* type, *Myosotis* type, *Omphalodes* type, *Onosma, Onosma* type, *Pulmonaria, Pulmonaria* type, *Symphytum, Symphytum* type
Brassicaceae	*Arabidopsis, Barbarea* type, *Brassica, Brassica* type, Brassicaceae, *Capsella bursa-pastoris* type, *Capsella* type, *Cardamine, Cardamine pratensis* type, *Cardamine* type, *Descurainia, Draba, Draba* type, *Hornungia* type, *Matthiola, Sinapis, Sinapis* type
Bruckenthalia	*Bruckenthalia*
Buxus	*Buxus, Buxus sempervirens*
Calluna	*Calluna, Calluna* type, *Calluna vulgaris*
Campanulaceae	*Campanula, Campanula* type, Campanulaceae, *Jasione, Jasione montana, Jasione* type, *Legousia, Lobelia, Lobelia dortmanna, Lobelia* type, *Phyteuma, Phyteuma* type
Capparaceae	Capparidaceae, *Capparis, Capparis spinosa, Capparis* type

Caprifoliaceae	Caprifoliaceae, Dipsacaceae, *Dipsacus, Dipsacus fullonum* type, *Dipsacus* type, *Knautia, Knautia arvensis, Knautia* type, *Patrinia, Scabiosa, Scabiosa columbaria* type, *Scabiosa rotata* type, *Scabiosa* type, *Scabiosa/Succisa* type
Caragana	*Caragana*
Carduoideae	*Arctium, Arctium* type, *Arctium/Jurinea*, Carduoideae, *Carduus, Carduus* type, *Carlina, Carlina* type, *Carthamus, Centaurea, Centaurea collina, Centaurea collina* type, *Centaurea cyanus, Centaurea cyanus* type, *Centaurea depressa* type, *Centaurea diffusa, Centaurea jacea, Centaurea jacea* type, *Centaurea montana, Centaurea montana* type, *Centaurea nigra, Centaurea nigra* type, *Centaurea rhenana* type, *Centaurea scabiosa, Centaurea scabiosa* type, *Centaurea solstitialis, Centaurea solstitialis* type, *Centaurea* type, *Cirsium, Cirsium* type, *Cirsium/Carduus, Cirsium/Carduus* type, *Cirsium/Gundelia, Cousinia, Echinops, Echinops ritro, Jurinea* type, *Onopordum* type, *Saussurea, Saussurea alpina, Saussurea* type, *Serratula, Serratula* type
Carpinus betulus	*Carpinus, Carpinus betulus, Carpinus betulus* type, *Carpinus* type
Carpinus orientalis/Ostrya	*Carpinus orientalis, Carpinus orientalis* type, *Carpinus orientalis/Ostrya, Carpinus orientalis/Ostrya carpinifolia, Carpinus orientalis/Ostrya carpinifolia* type, *Carpinus/Ostrya, Ostrya, Ostrya* type

Caryophyllaceae	*Agrostemma, Agrostemma githago, Arenaria, Arenaria* type, Caryophyllaceae, Caryophyllaceae subfam. Silenoideae, *Cerastium, Cerastium alpinum* type, *Cerastium arvense* type, *Cerastium cerastioides* type, *Cerastium fontanum* type, *Cerastium* type, *Cerastium/Stellaria* type, *Corrigiola, Dianthus, Dianthus superbus* type, *Dianthus* type, *Frankenia, Frankenia hirsuta* type, *Gypsophila, Gypsophila fastigiata, Gypsophila repens* type, *Gypsophila* type, *Herniaria, Herniaria glabra, Herniaria* type, *Herniaria/Paronychia, Illecebrum, Loeflingia, Lychnis, Lychnis flos-cuculi, Lychnis flos-cuculi* type, *Lychnis* type, *Lychnis viscaria* type, *Minuartia, Minuartia rubra* type, *Minuartia* type, *Minuartia verna* type, *Moehringia* type, *Paronychia, Paronychia* type, *Polycarpon, Sagina, Sagina procumbens, Sagina* type, *Saponaria, Scleranthus, Scleranthus annuus, Scleranthus perennis, Scleranthus* type, Silenaceae, *Silene, Silene acaulis, Silene acaulis* type, *Silene alba* type, *Silene dioica* type, *Silene latifolia, Silene rupestris, Silene* type, *Silene vulgaris* type, *Spergula, Spergula arvensis, Spergula* type, *Spergula/Spergularia, Spergularia, Spergularia* type, *Stellaria, Stellaria holostea, Stellaria holostea* type, *Stellaria nemorum, Stellaria nemorum* type, *Stellaria palustris, Stellaria* type, *Succisa, Succisa pratensis, Succisa pratensis* type, *Succisa* type
Cassiope	*Cassiope, Cassiope* type
Castanea	*Castanea, Castanea sativa, Castanea* type
Cedrus	*Cedrus, Cedrus atlantica, Cedrus atlantica* type, *Cedrus libani*
Celastraceae	Celastraceae, *Parnassia, Parnassia palustris*
Celtis	*Celtis, Celtis australis*
Ceratonia	*Ceratonia, Ceratonia siliqua, Ceratonia* type
Cercis	*Cercis siliquastrum*
Chamaedaphne	*Chamaedaphne, Chamaedaphne calyculata*
Chamaerops	*Chamaerops*
Chimaphila	*Chimaphila umbellata*
Cichorioideae	Cichorioideae, *Cichorium, Cichorium intybus* type, *Cichorium* type, *Crepis, Crepis aurea, Crepis* type, *Hieracium* type, *Lactuca, Lactuca sativa* type, *Lactuca* type, *Leontodon helveticus, Leontodon* type, *Scorzonera humilis* type, *Scorzonera* type, *Sonchus* type, *Taraxacum, Taraxacum* type
Cimicifuga	*Cimicifuga foetida*
Cistaceae	Cistaceae, *Halimium/Tuberaria, Tuberaria*
Cistus	*Cistus, Cistus albidus* type, *Cistus incanus* type, *Cistus ladanifer, Cistus ladanifer* type, *Cistus monspeliensis, Cistus monspeliensis* type, *Cistus populifolius* type, *Cistus salvifolius, Cistus salviifolius* type, *Cistus* type, *Cistus villosus* type

Clematis	*Clematis, Clematis* type, *Clematis vitalba* type
Clethra	*Clethra*
Clusiaceae	*Guttiferae*
Colchicaceae	*Colchicum, Colchicum autumnale* type, *Colchicum* type, *Colchicum/Merendera, Merendera*
Colutea	*Colutea*
Consolida	*Consolida* type
Convolvulaceae	*Calystegia, Calystegia sepium,* Convolvulaceae, *Convolvulus, Convolvulus arvensis, Convolvulus arvensis* type, *Corema album* type, *Cuscuta, Cuscuta europaea* type
Coriaria	*Coriaria, Coriaria myrtifolia*
Cornus	*Cornaceae, Cornus, Cornus mas, Cornus mas/Cornus suecica, Cornus sanguinea, Cornus suecica*
Corylus	*Corylus, Corylus avellana, Corylus avellana* type, *Corylus maxima, Corylus* type
Cotinus	*Cotinus, Cotinus coggygria, Cotinus* type
Cotoneaster	*Cotoneaster*
Crassulaceae	*Crassula,* Crassulaceae, *Sedum, Sedum rosea, Sedum* type, *Sempervivum, Umbilicus, Umbilicus rupestris* type
Crataegus	*Crataegus, Crataegus monogyna, Crataegus* type
Cucurbitaceae	*Cucumis,* Cucurbitaceae
Cupressaceae	Cupressaceae, *Cupressus, Cupressus* type, *Juniperus, Juniperus communis, Juniperus communis* type, *Juniperus excelsa/Juniperus oxycedrus, Juniperus sabina, Juniperus* type, Taxodiaceae, *Taxodium*
Cynomorium	*Cynomorium*
Cyperaceae	*Carex, Carex hirta* type, *Carex* type, Cyperaceae, *Cyperus, Cyperus longus* type, *Cyperus* type, *Eleocharis palustris, Eriophorum angustifolium/Eriophorum vaginatum, Eriophorum* type, *Rhynchospora, Rhynchospora alba, Schoenoplectus lacustris* ssp *lacustris, Schoenoplectus* type, *Schoenus* type, *Scirpus, Scirpus lacustris* type, *Scirpus* type, *Trichophorum caespitosum*
Cytinaceae	*Cytinus hypocistis* type
Daphne	*Daphne, Daphne gnidium, Daphne gnidium* type, *Daphne* type
Datisca	*Datisca*
Delphinium	*Delphinium* type
Dennstaedtiaceae	*Pteridium, Pteridium aquilinum, Pteridium aquilinum* type, *Pteridium* type
Diapensia	*Diapensia, Diapensia lapponica*
Dryas	*Dryas, Dryas octopetala*
Elaeagnus	*Elaeagnus, Elaeagnus angustifolia*
Empetrum	*Empetrum, Empetrum nigrum, Empetrum nigrum* type, *Empetrum* type

Ephedra	*Ephedra, Ephedra alata* type, *Ephedra distachya, Ephedra distachya* type, *Ephedra fragilis, Ephedra fragilis* ssp *campylopoda, Ephedra fragilis* type, *Ephedra major, Ephedra* type
Equisetum	*Equisetum*
Erica	*Erica, Erica arborea, Erica arborea* type, *Erica australis, Erica australis* type, *Erica cinerea, Erica cinerea* type, *Erica erigena* type, *Erica lusitanica, Erica lusitanica* type, *Erica scoparia* type, *Erica spiculifolia, Erica tetralix, Erica tetralix* type, *Erica* type, *Erica umbellata* type
Ericaceae	*Empetrum/Ledum,* Ericaceae, *Ericales, Lecythis, Moneses, Orthilia, Phyllodoce, Pyrola*
Euonymus	*Euonymus, Euonymus europaeus*
Euphorbiaceae	*Acalypha, Crozophora, Euphorbia, Euphorbia* type, Euphorbiaceae
Fabaceae	Fabaceae
Fabaceae (herbs)	*Anthyllis, Coronilla, Galega* type, *Hedysarum hedysaroides, Hedysarum/Ebenus, Hippocrepis comosa, Hippocrepis* type, *Lathyrus, Lathyrus* type, *Lathyrus/Vicia, Lathyrus/Vicia, Lathyrus/Vicia* type, *Lotus, Lotus corniculatus, Lotus corniculatus* type, *Lotus* type, *Lotus uliginosus, Medicago, Medicago littoralis* type, *Medicago sativa, Medicago* type, *Melilotus, Melilotus officinalis, Melilotus* type, *Onobrychis, Onobrychis* type, *Oxytropis, Phaseolus* type, *Psoralea, Trifolium, Trifolium alpinum* type, *Trifolium badium* type, *Trifolium montanum, Trifolium pratense, Trifolium pratense* type, *Trifolium repens, Trifolium repens* type, *Trifolium spadiceum* type, *Trifolium* type, *Vicia, Vicia cracca, Vicia cracca* type, *Vicia faba* type, *Vicia lathyroides, Vicia sylvatica* type, *Vicia* type, Viciaceae
Fagus	*Fagus, Fagus orientalis, Fagus sylvatica*
Flueggea	*Securinega tinctoria* type
Frangula	*Frangula, Frangula alnus*
Fraxinus	*Fraxinus, Fraxinus angustifolia, Fraxinus angustifolia* subsp *oxycarpa, Fraxinus angustifolia* type, *Fraxinus excelsior, Fraxinus excelsior* type, *Fraxinus ornus, Fraxinus ornus* type, *Fraxinus oxycarpa* type
Genisteae	*Cytisus* type, *Cytisus/Genista, Cytisus/Genista* type, *Cytisus/Ulex, Genista, Genista* type, *Genista/Ulex, Sarothamnus scoparius, Spartium, Ulex, Ulex* type
Gentianaceae	*Centaurium, Centaurium maritimum, Centaurium* type, *Gentiana, Gentiana lutea/Gentiana pneumonanthe, Gentiana nivalis* type, *Gentiana pneumonanthe, Gentiana pneumonanthe* type, *Gentiana purpurea, Gentiana purpurea* type, Gentianaceae, *Gentianella,*

Gentianella campestris type, *Gentianella germanica* type, *Swertia perennis*

Geraniaceae	*Erodium, Geraniaceae, Geranium, Geranium sylvaticum* type, *Geranium* type
Halimium	*Halimium, Halimium* type
Hedera	*Hedera, Hedera helix, Hedera* type
Helianthemum	*Helianthemum, Helianthemum croceum* type, *Helianthemum nummularium* type, *Helianthemum salicifolium* type, *Helianthemum* type
Helleborus	*Helleborus, Helleborus foetidus, Helleborus* type, *Helleborus viridis* type
Hepatica	*Hepatica*
Hippophae	*Hippophae, Hippophae rhamnoides*
Huperzia	*Huperzia selago, Huperzia selago* type, *Lycopodium selago*
Hymenophyllaceae	*Hymenophyllum tunbrigense, Hymenophyllum wilsonii, Trichomanes speciosum*
Hypericaceae	*Hypericum, Hypericum perforatum* type, *Hypericum pulchrum* type, *Hypericum* type
Ilex	*Ilex, Ilex aquifolium, Ilex* type
Impatiens	*Impatiens*
Iridaceae	*Crocus*, Iridaceae, *Iris, Iris humilis, Iris pseudacorus, Iris pseudacorus* type, *Iris* type
Jasminum	*Jasminum, Jasminum fruticans, Jasminum* type
Juglandaceae	Juglandaceae
Juglans	*Juglans, Juglans regia*
Juncaceae	Juncaceae, *Juncus, Luzula*
Kalmia	*Loiseleuria procumbens*
Koenigia	*Koenigia islandica*
Laburnum	*Laburnum anagyroides*
Lamiaceae	*Ajuga, Ballota, Galeopsis, Galeopsis* type, *Galeopsis/Ballota* type, *Glechoma* type, Lamiaceae, *Lamium, Lamium* type, *Lycopus, Lycopus* type, *Lycopus/Mentha, Marrubium, Mentha, Mentha* type, *Mentha/Thymus, Mentha/Thymus* type, *Nepeta, Origanum vulgare, Prunella, Prunella* type, *Prunella vulgaris* type, *Scutellaria* type, *Sideritis, Stachys, Stachys sylvatica* type, *Stachys sylvestris, Stachys* type, *Thymus, Thymus serpyllum, Thymus* type
Larix	*Larix, Larix decidua, Larix decidua* type, *Larix* type, *Larix/Pseudotsuga*
Laurus	*Laurus*
Lavandula	*Lavandula stoechas* type

Ledum	*Ledum, Ledum palustre, Ledum* type
Ligustrum	*Ligustrum, Ligustrum vulgare, Ligustrum vulgare* type, *Olea/Ligustrum*
Liliaceae	*Allium, Allium* type, *Anthericum, Anthericum* type, *Asphodeline, Asphodelus, Asphodelus albus, Asphodelus albus* type, *Asphodelus fistulosus* type, *Asphodelus* type, *Fritillaria lusitanica, Gagea,* Liliaceae, *Lilium, Lilium martagon* type, *Lloydia serotina, Tulipa*
Linaceae	Linaceae, *Radiola linoides*
Linnaea	*Linnaea, Linnaea borealis*
Linum	*Linum, Linum catharticum, Linum catharticum* type
Lonicera	*Lonicera, Lonicera caerulea, Lonicera hispida, Lonicera implexa, Lonicera periclymenum, Lonicera* type, *Lonicera xylosteum* type
Loranthaceae	Loranthaceae, *Loranthus*
Lycopodiella	*Lepidotis inundata, Lycopodium inundatum*
Lycopodium	*Diphasiastrum, Diphasiastrum alpinum, Diphasium, Diphasium alpinum, Diphasium alpinum* type, *Diphasium complanatum, Diphasium tristachyum, Diphasium* type, *Lycopodium, Lycopodium alpinum, Lycopodium annotinum, Lycopodium annotinum* type, *Lycopodium clavatum, Lycopodium clavatum* type, *Lycopodium complanatum, Lycopodium dubium, Lycopodium* type
Lysimachia	*Lysimachia, Lysimachia maritima, Lysimachia nemorum, Lysimachia thyrsiflora, Lysimachia* type, *Lysimachia vulgaris, Lysimachia vulgaris* type
Lythraceae	Lythraceae, *Lythrum, Lythrum salicaria, Lythrum salicaria* type, *Lythrum salicaria/Lythrum hyssopifolia, Peplis*
Magnoliaceae	Magnoliaceae
Malus	*Malus, Malus* type
Malvaceae	*Hibiscus, Malva, Malva sylvestris* type, *Malva* type, Malvaceae, *Sterculia*
Melanthiaceae	*Veratrum, Veratrum* type
Mercurialis	*Mercurialis, Mercurialis annua, Mercurialis annua* type, *Mercurialis perennis, Mercurialis perennis* type
Moltkia	*Moltkia*
Montiaceae	*Montia, Montia fontana*
Moraceae	*Ficus,* Moraceae, *Morus, Morus alba, Morus alba* type, *Morus nigra*
Myrica	*Corylus/Myrica, Myrica, Myrica gale, Myrica gale* type, *Myrica* type
Myricaria	*Myricaria, Myricaria* type
Myrtaceae	Myrtaceae, *Myrtus, Myrtus communis*
Nartheciaceae	*Narthecium, Narthecium ossifragum, Narthecium* type
Nerium	*Nerium, Nerium oleander*

Nigella	*Nigella*
Nitrariaceae	*Nitraria, Peganum, Peganum harmala*
Olea	*Olea, Olea europaea, Olea* type
Oleaceae	Oleaceae
Onagraceae	*Chamaenerion, Chamaenerion angustifolium, Circaea, Epilobium, Epilobium* type, Onagraceae
Ononis	*Ononis, Ononis* type
Ophioglossaceae	*Botrychium, Botrychium lunaria, Botrychium lunaria* type, *Botrychium* type, Ophioglossaceae, *Ophioglossum, Ophioglossum vulgatum*
Orchidaceae	*Neottia* type, Orchidaceae
Osmundaceae	*Osmunda, Osmunda regalis*
Oxalidaceae	Oxalidaceae, *Oxalis, Oxalis acetosella, Oxalis stricta*
Oxyria/Rumex	*Oxyria, Oxyria digyna, Oxyria* type, *Oxyria/Rumex, Rumex, Rumex acetosa, Rumex acetosa* type, *Rumex acetosa/Oxyria* type, *Rumex acetosa/Rumex acetosella, Rumex acetosa/Rumex acetosella* type, *Rumex acetosa/Rumex scutatus* type, *Rumex acetosella, Rumex acetosella* type, *Rumex alpestris, Rumex alpinus, Rumex alpinus* type, *Rumex aquaticus, Rumex aquaticus* type, *Rumex conglomeratus* type, *Rumex crispus, Rumex crispus* type, *Rumex hydrolapathum, Rumex longifolius, Rumex longifolius* type, *Rumex obtusifolius* type, *Rumex sanguineus* type, *Rumex* type
Paeonia	*Paeonia*
Paliurus	*Paliurus, Paliurus spina-christi*
Papaveraceae	*Chelidonium majus, Corydalis, Corydalis solida* type, *Corydalis* type, *Fumana, Fumaria, Fumaria officinalis* type, *Glaucium, Glaucium* type, *Hypecoum, Papaver, Papaver argemone, Papaver rhoeas* type, *Papaver* type, Papaveraceae, *Roemeria, Roemeria hybrida* type
Parrotia	*Parrotia persica, Parrotia persica* type
Periploca	*Periploca*
Phillyrea	*Fontanesia/Phillyrea, Olea/Phillyrea, Phillyrea, Phillyrea angustifolia, Phillyrea angustifolia* type, *Phillyrea media, Phillyrea* type
Phlomis	*Phlomis*
Phyllanthaceae	*Andrachne, Andrachne telephioides*
Picea	*Picea, Picea abies, Picea abies* subsp *abies*
Picea orientalis	*Picea orientalis*
Pinus (diploxylon)	*Pinus, Pinus (Diploxylon), Pinus halepensis, Pinus nigra* type, *Pinus non-cembra, Pinus pinaster, Pinus pinaster* type, *Pinus pinaster/Pinus halepensis, Pinus pinea* type, *Pinus pinea/Pinus halepensis* type, *Pinus sylvestris, Pinus sylvestris* type, *Pinus sylvestris/Pinus nigra* type, *Pinus* type
Pinus (haploxylon)	*Pinus (Haploxylon), Pinus cembra, Pinus cembra* type, *Pinus peuce, Pinus pumila, Pinus sibirica*

Pistacia	*Pistacia, Pistacia lentiscus, Pistacia lentiscus* type, *Pistacia terebinthus, Pistacia terebinthus* type, *Pistacia* type
Plantaginaceae	*Globularia, Gratiola officinalis, Hippuris vulgaris,* Plantaginaceae, *Plantago, Plantago afra* type, *Plantago albicans, Plantago alpina, Plantago alpina* type, *Plantago coronopus, Plantago coronopus* type, *Plantago cylindrica* type, *Plantago lagopus* type, *Plantago lanceolata, Plantago lanceolata* type, *Plantago lanceolata/Plantago major* type, *Plantago lusitanica, Plantago major, Plantago major* type, *Plantago maritima, Plantago maritima* type, *Plantago maritima/Plantago alpina* type, *Plantago media, Plantago media* type, *Plantago media/Plantago major, Plantago media/Plantago major* type, *Plantago montana* type, *Plantago ovata* type, *Plantago psyllium* type, *Plantago tenuiflora* type, *Plantago* type
Platanus	*Platanus, Platanus orientalis, Platanus* type
Plumbaginaceae	*Acantholimon, Armeria, Armeria maritima, Armeria maritima* subsp *elongata, Armeria* type, *Armeria/Limonium, Armeria/Limonium* type, *Goniolimon, Limonium, Limonium* type, *Limonium vulgare,* Plumbaginaceae
Poaceae	*Anthoxanthum, Deschampsia, Elymus, Glyceria, Lygeum, Lygeum spartum, Nardus, Poa/Festuca* type, Poaceae, *Setaria*
Polemoniaceae	*Polemoniaceae, Polemonium, Polemonium caeruleum*
Polygalaceae	*Polygala, Polygala comosa* type, *Polygala* type, *Polygala vulgaris, Polygala vulgaris* type, Polygalaceae, *Polygaloides chamaebuxus*
Polygonaceae	*Atraphaxis, Bilderdykia convolvulus, Bilderdykia convolvulus* type, *Bistorta officinalis* type, *Bistorta vivipara, Calligonum, Fallopia, Fallopia convolvulus, Fallopia convolvulus* type, *Persicaria, Persicaria amphibia,* Polygonaceae, *Pteropyrum, Rheum, Rheum* type
Polygonum	*Polygonum, Polygonum alpinum, Polygonum amphibium, Polygonum amphibium* type, *Polygonum aviculare, Polygonum aviculare* type, *Polygonum aviculare/Polygonum bistorta* type, *Polygonum bistorta, Polygonum bistorta* type, *Polygonum bistorta/Polygonum viviparum, Polygonum cognatum, Polygonum cognatum* type, *Polygonum convolvulus, Polygonum convolvulus* type, *Polygonum oxyspermum* type, *Polygonum persicaria, Polygonum persicaria* type, *Polygonum sect. persicaria, Polygonum* type, *Polygonum viviparum*

Polypodiales	*Asplenium, Asplenium ceterach* subsp *ceterach, Asplenium* type, *Asplenium viride, Athyrium, Athyrium alpestre* type, *Athyrium distentifolium, Athyrium distentifolium* type, *Athyrium filix-femina, Blechnum, Blechnum spicant, Cystopteris, Cystopteris fragilis, Cystopteris* type, Dryopteridaceae/Polypodiaceae, *Dryopteris, Dryopteris carthusiana, Dryopteris carthusiana* type, *Dryopteris cristata, Dryopteris cristata* type, *Dryopteris dilatata, Dryopteris dilatata* type, *Dryopteris expansa, Dryopteris filix-mas, Dryopteris filix-mas* type, *Dryopteris* type, *Dryopteris/Thelypteris, Grammitis, Gymnocarpium, Gymnocarpium dryopteris, Matteuccia struthiopteris, Pilularia*, Polypodiaceae, *Polypodiales, Polypodium, Polypodium serratum, Polypodium vulgare, Polypodium vulgare* type, *Polystichum, Polystichum* type, *Thelypteris, Thelypteris palustris, Thelypteris palustris* type, *Thelypteris phegopteris, Thelypteris* type
Populus	*Populus, Populus tremula, Populus tremula* type
Portulacaceae	Portulacaceae
Potentilla	*Potentilla, Potentilla aurea, Potentilla recta, Potentilla* type
Primulaceae	*Anagallis, Anagallis arvensis, Anagallis arvensis* type, *Anagallis tenella, Anagallis* type, *Androsace*, Androsaceae, *Cyclamen, Cyclamen hederifolium, Primula, Primula clusiana* type, *Primula farinosa, Primula farinosa* type, *Primula hirsuta* type, *Primula* type, *Primula veris* type, *Primula vulgaris, Primula vulgaris* type, Primulaceae, *Soldanella, Trientalis, Trientalis europaea*
Prosopis	*Prosopis*
Prunus	*Prunus, Prunus avium, Prunus padus, Prunus spinosa* type, *Prunus* type
Pteridaceae	*Adiantum, Cheilanthes, Cheilanthes* type, *Cryptogramma, Cryptogramma crispa, Cryptogramma crispa* type, *Cryptomeria japonica, Pteris*
Pterocarya	*Pterocarya, Pterocarya fraxinifolia, Pterocarya pterocarpa*
Pulsatilla	*Pulsatilla*
Punica	*Punica*
Pyrus	*Pyrus, Pyrus* type
Quercus (deciduous)	*Quercus, Quercus cerris, Quercus cerris* type, *Quercus deciduous, Quercus infectoria* type, *Quercus petraea, Quercus robur, Quercus robur* type, *Quercus robur/Quercus petraea*
Quercus (evergreen)	*Quercus coccifera, Quercus coccifera* type, *Quercus coccifera/Quercus ilex, Quercus evergreen, Quercus ilex, Quercus ilex* type, *Quercus rotundifolia* type, *Quercus suber, Quercus suber* type

Quercus (intermediate)	*Quercus canariensis* type, *Quercus cerris/Quercus suber, Quercus cerris/Quercus suber* type, *Quercus faginea, Quercus faginea/Quercus pubescens, Quercus faginea/Quercus pyrenaica, Quercus pubescens* type, *Quercus pyrenaica* type, *Quercus robur/Quercus pubescens* type
Ranunculaceae	Ranunculaceae
Ranunculus	*Ranunculus, Ranunculus acer* type, *Ranunculus aconitifolius, Ranunculus aconitifolius* type, *Ranunculus acris, Ranunculus acris* type, *Ranunculus arvensis, Ranunculus arvensis* type, *Ranunculus asiaticus* type, *Ranunculus ficaria* type, *Ranunculus flammula* type, *Ranunculus glacialis* type, *Ranunculus montanus* type, *Ranunculus nivalis* type, *Ranunculus parviflorus, Ranunculus repens* type, *Ranunculus sceleratus* type, *Ranunculus* type
Resedaceae	*Reseda, Reseda lutea, Reseda lutea* type, Resedaceae
Rhamnaceae	Rhamnaceae
Rhamnus	*Rhamnus, Rhamnus catharticus, Rhamnus* type
Rhododendron	*Rhododendron, Rhododendron ferrugineum, Rhododendron* type
Rhus	*Rhus, Rhus coriaria*
Ribes	*Ribes, Ribes* type
Robinia	*Robinia pseudacacia*
Rosaceae	*Agrimonia, Agrimonia* type, *Alchemilla, Alchemilla pentaphylla* type, *Alchemilla* type, *Aruncus* type, *Filipendula, Filipendula* type, *Filipendula ulmaria, Filipendula vulgaris, Fragaria, Geum, Geum rivale* type, *Geum* type, *Pirus* type, *Prunus/Rubus* type, *Pyrus/Malus, Rosa, Rosa canina* type, *Rosa* type, *Rosa/Prunus,* Rosaceae, Rosaceae subfam. Maloideae, *Rosaceae subgen. Amygdalus, Spiraea*
Rosmarinus	*Rosmarinus, Rosmarinus* type
Rubiaceae	*Asperula* type, *Galium, Galium* type, *Rubiaceae, Theligonum, Theligonum cynocrambe*
Rubus	*Rubus, Rubus arcticus, Rubus arcticus* type, *Rubus chamaemorus, Rubus fruticosus* type, *Rubus idaeus* type, *Rubus saxatilis, Rubus* type
Ruscus	*Ruscus*
Rutaceae	*Haplophyllum, Ruta,* Rutaceae
Salix	*Salix, Salix glauca* type, *Salix helvetica* type, *Salix herbacea, Salix herbacea* type, *Salix herbacea/Salix reticulata, Salix pentandra* type, *Salix polaris*
Salvia	*Salvia, Salvia* type, *Salvia verticillata* type
Sambucus	*Sambucus, Sambucus nigra, Sambucus nigra* type, *Sambucus nigra/Sambucus racemosa, Sambucus racemosa, Sambucus* type

Sanguisorba group	*Poterium, Poterium* type, *Sanguisorba, Sanguisorba minor, Sanguisorba minor* ssp *minor, Sanguisorba minor* type, *Sanguisorba minor/Poterium, Sanguisorba officinalis, Sanguisorba officinalis* type, *Sanguisorba* type, *Sarcopoterium spinosum/Sanguisorba minor, Sarcopoterium* type
Santalaceae	*Arceuthobium oxycedri, Osyris alba* type, *Thesium*
Saxifragaceae	*Bergenia crassifolia, Chrysosplenium, Chrysosplenium* type, *Micranthes nivalis* type, *Saxifraga, Saxifraga cernua* type, *Saxifraga cespitosa* type, *Saxifraga foliolosa* type, *Saxifraga granulata, Saxifraga granulata* type, *Saxifraga hirculus* type, *Saxifraga oppositifolia, Saxifraga oppositifolia* type, *Saxifraga paniculata* type, *Saxifraga stellaris, Saxifraga stellaris* type, *Saxifraga tricuspidata,* Saxifragaceae
Scrophulariaceae	*Antirrhinum* type, *Antirrhinum/Linaria, Digitalis, Digitalis purpurea* type, *Digitalis* type, *Euphrasia, Euphrasia* type, *Linaria, Linaria* type, *Melampyrum, Pedicularis, Pedicularis oederi* type, *Pedicularis palustris* type, *Pedicularis* type, *Pedicularis verticillata* type, *Rhinanthus, Rhinanthus* type, *Scrophularia, Scrophularia* type, *Scrophularia/Verbascum, Scrophularia/Verbascum* type, *Scrophularia/Verbascum/Digitalis,* Scrophulariaceae, *Verbascum, Verbascum* type, *Veronica, Veronica* type
Smilax	*Smilax*
Solanaceae	*Capsicum* type, *Datura, Hyoscyamus, Lycium, Solanaceae, Solanum, Solanum dulcamara, Solanum nigrum, Solanum nigrum* type
Sorbus	*Sorbus, Sorbus aria, Sorbus aucuparia, Sorbus aucuparia* type, *Sorbus* type
Staphyleaceae	*Staphylea, Staphylea pinnata*
Styrax	*Styrax, Styrax officinalis*
Suaeda	*Suaeda* type
Syringa	*Syringa*
Tamarix	*Tamarix*
Taxus	*Taxus, Taxus baccata*
Teucrium	*Teucrium, Teucrium* type
Thalictrum	*Thalictrum, Thalictrum alpinum, Thalictrum aquilegiifolium, Thalictrum flavum* type, *Thalictrum lucidum, Thalictrum* type
Thymelaeaceae	*Thymelaea,* Thymelaeaceae
Tilia	*Tilia, Tilia cordata, Tilia cordata* type, *Tilia dasystyla, Tilia platyphyllos, Tilia platyphyllos* type
Tofieldia	*Tofieldia*
Trollius	*Trollius, Trollius europaeus, Trollius* type
Ulmus	*Ulmus, Ulmus glabra, Ulmus glabra* type, *Ulmus minor*
Ulmus/Zelkova	*Ulmus/Zelkova, Zelkova, Zelkova* type

Urticaceae	*Parietaria, Parietaria/Urtica, Urtica, Urtica dioica, Urtica dioica* type, *Urtica pilulifera* type, *Urtica* type, *Urtica urens,* Urticaceae
Vaccinium	*Vaccinium, Vaccinium myrtillus, Vaccinium myrtillus* type, *Vaccinium oxycoccos, Vaccinium* type, *Vaccinium/Oxycoccus*
Valerianaceae	*Centranthus, Valeriana, Valeriana dioica* type, *Valeriana montana* type, *Valeriana officinalis, Valeriana officinalis* type, *Valeriana sambucifolia* type, *Valeriana tripteris* type, *Valeriana* type, Valerianaceae, *Valerianella*
Verbenaceae	*Verbena, Verbena officinalis*
Viburnum	*Viburnum, Viburnum opulus, Viburnum opulus* type, *Viburnum* type
Violaceae	*Viola, Viola arvensis* type, *Viola canina* type, *Viola odorata* type, *Viola palustris, Viola palustris* type, *Viola tricolor, Viola tricolor* type, *Viola tricolor/Viola arvensis,* Violaceae
Viscum	*Viscum, Viscum album, Viscum album* type, *Viscum* type
Vitex	*Vitex*
Ziziphus	*Ziziphus* type, *Zizyphus, Zizyphus lotus*
Zygophyllaceae	*Tribulus, Tribulus terrestris,* Zygophyllaceae, *Zygophyllum*

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1113 SI Table 3: The results of randomisation t-test on the leave-one-out cross-validated
1114 predictions of the weighted averaging-partial least squares (WA-PLS) regression
1115 models for 196 taxa (including Poaceae and Polypodiales). Selected components are
1116 marked in bold.
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WA-PLS component	RMSEP	r^2	Maximum bias	p
MTCO				
1	5.308	0.624	14.205	0.001
2	4.969	0.671	8.831	0.001
3	4.848	0.687	8.473	0.001
4	**4.821**	**0.690**	**10.263**	**0.018**
5	4.830	0.689	10.467	0.659
GDD_0				
1	987.264	0.600	2418.420	0.001
2	928.936	0.646	2154.084	0.001
3	909.864	0.660	2037.772	0.001
4	**906.829**	**0.663**	**2094.995**	**0.010**
5	907.692	0.662	2118.818	0.750
MI				
1	0.452	0.445	3.925	0.001
2	0.425	0.509	3.503	0.001
3	**0.421**	**0.519**	**3.483**	**0.001**
4	0.420	0.520	3.553	0.225

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SI Table 4: Reconstructed mean temperature of the coldest month (MTCO, °C), growing degree days above a base level of 0°C (GDD_0) and moisture index (the ratio of annual precipitation to annual potential evapotranspiration, MI) for each of the samples. We give the depth and age for each sample. For the reconstructions of MI, we give values before and after the [CO_2] correction.

Depth (cm)	Age (cal yr BP)	Mean Temperature of the Coldest Month (°C)	Growing Degree Days Above Zero	Original Moisture Index	Corrected Moisture Index
40	1655.9	2.32	4296	0.54	0.70
49	2093.5	2.33	4291	0.49	0.65
52	2239.4	3.18	4528	0.52	0.71
55	2385.3	2.41	4495	0.52	0.71
62	2725.7	5.13	4654	0.43	0.65
65	2871.7	6.83	4853	0.32	0.58
67	2968.9	5.72	4625	0.47	0.68
69	3066.1	5.94	4465	0.36	0.55
71	3163.4	-0.33	3238	0.79	0.80
74	3309.3	1.21	3634	0.69	0.76
75	3358	-0.18	3345	0.76	0.79
77	3455.3	2.24	3914	0.63	0.74
80	3601.1	1.83	4019	0.61	0.74
85	3844.3	0.55	3481	0.72	0.78
89	4038.9	0.72	3572	0.66	0.73
90	4087.5	0.68	3480	0.70	0.76
93	4233.3	1.75	3481	0.69	0.75
97	4427.9	0.14	3134	0.86	0.87
99	4525.1	0.49	3784	0.58	0.69
112	5157.3	2.68	4198	0.49	0.66
114	5254.5	3.66	4203	0.53	0.70
116	5351.9	4.68	4664	0.44	0.69
119	5497.7	2.52	3872	0.65	0.78
127	5886.7	2.04	3932	0.61	0.75
128	5935.4	2.61	4246	0.55	0.74
129	5984.1	2.93	4335	0.56	0.76
139	6470.4	1.76	4189	0.58	0.76
141	6567.6	1.65	4067	0.64	0.81
144	6713.5	0.79	3881	0.66	0.81
146	6810.9	1.37	3537	0.67	0.77
150	7005.4	1.58	3781	0.60	0.73
152	7102.6	1.70	3644	0.69	0.80
154	7199.9	2.98	3966	0.73	0.89
157	7345.8	1.94	4061	0.56	0.73

160	7491.9	3.68	4221	0.58	0.78
163	7637.8	0.09	3348	0.80	0.87
166	7783.9	-0.43	3239	0.74	0.79
168	7881.1	-0.65	3203	0.81	0.86
171	8027.1	-1.03	2876	0.88	0.87
173	8124.3	-0.97	2946	0.86	0.86
174	8173	-1.10	3381	0.65	0.72
177	8319	0.52	3634	0.54	0.65
182	8562.3	-0.23	3696	0.58	0.70
184	8659.5	-1.36	3589	0.57	0.67
188	8854.2	0.03	2843	0.91	0.90
195	9194.8	0.73	4623	0.30	0.56
198	9340.7	1.06	5052	0.16	0.49
199	9389.3	0.69	4779	0.21	0.50
200	9437.9	1.21	4486	0.40	0.63
202	9535.1	-0.31	4767	0.27	0.55
203	9583.8	0.30	4572	0.34	0.58
205	9681	2.15	5007	0.27	0.58
208	9827	1.42	4878	0.31	0.59
211	9973.1	-1.52	3159	0.82	0.84
213	10070.4	1.79	4741	0.36	0.62
216	10216	-0.21	3499	0.73	0.80
219	10361.9	3.16	4984	0.33	0.62
222	10507.8	-0.75	3424	0.74	0.80
225	10653.8	1.71	4886	0.32	0.61
227	10751	0.96	3607	0.76	0.86
229	10848.1	-0.47	4368	0.39	0.60
231	10945.4	-1.15	2942	1.02	1.01
235	11140	-1.45	2967	0.98	0.97
237	11237.4	-2.14	2723	1.03	0.98
240	11383.4	0.35	3213	1.02	1.06
242	11480.7	-1.53	2649	1.17	1.11
244	11577.7	-1.02	3421	0.81	0.89
246	11675	-0.60	2921	1.12	1.14
249	11820.9	-1.43	2807	1.06	1.05
252	11966.7	-1.75	3294	0.83	0.90
254	12064	-1.41	3414	0.89	0.99
259	12307.3	-2.14	2439	1.32	1.26
261	12404.3	-1.67	2702	1.16	1.17
264	12504.6	-2.47	2426	1.26	1.21
267	12605.1	-2.21	2288	1.35	1.29
269	12672.1	-1.81	2886	0.99	1.03
274	12839.2	-1.63	3094	0.98	1.06

279	13006.4	-0.79	3459	0.79	0.94
281	13073.4	-2.12	2269	1.36	1.31
288	13307.2	-1.11	3601	0.71	0.88
290	13374.3	-0.84	3720	0.64	0.82
291	13407.8	-1.42	2649	1.24	1.27
293	13474.6	-0.66	3895	0.67	0.89
296	13575	-1.98	2415	1.36	1.34
299	13675.2	-0.67	3522	0.79	0.95
303	13809.1	-1.98	2235	1.42	1.37
306	13909.1	-1.12	2631	1.29	1.32
308	13976.1	-0.78	3636	0.69	0.86
311	14076.5	-1.66	2693	1.16	1.19
316	14243.7	-1.81	2354	1.40	1.37
321	14410.8	-1.44	2747	1.23	1.28
326	14577.8	-1.81	2606	1.26	1.29
332	14778.5	-2.09	2365	1.39	1.39
335	14878.8	-1.69	2531	1.30	1.33
339	15012.4	-1.14	2619	1.20	1.26
340	15046	-1.33	2536	1.30	1.35
366	15917.7	-1.93	2566	1.24	1.32
371	16085	0.80	4274	0.59	0.92
581	22327.5	0.20	3084	1.02	1.32
604	22836.3	-1.09	3221	0.83	1.13
643	23698	-1.66	2599	1.20	1.43
666	24206.4	-1.16	3188	0.84	1.15
728	25577.7	-0.79	3857	0.54	0.92
731	25644.2	1.68	4531	0.47	0.96
751	26087	3.65	5396	0.28	0.89
759	26264.1	3.29	5168	0.32	0.90
770	26414.2	1.19	4703	0.37	0.88
811	26897	1.66	4765	0.37	0.89
823	27038.9	1.86	4939	0.32	0.87
867	27558.3	1.47	4457	0.49	0.96
894	27876.4	0.06	4145	0.51	0.94
905	28006.3	2.72	4943	0.39	0.92
911	28076.8	-0.05	4028	0.55	0.96
919	28171	-0.42	4236	0.45	0.89
957	28618.7	1.37	4624	0.41	0.90
967	28736.5	0.08	4330	0.44	0.89
1019	29301.3	0.89	4430	0.45	0.91
1117	29877	2.02	4564	0.47	0.95
1141	30017.8	-0.63	3758	0.59	0.96
1153	30087.9	-2.44	3572	0.70	1.02

1177	30227.7	-0.28	4182	0.49	0.91
1201	30367.4	0.25	4638	0.32	0.81
1211	30426.1	-0.04	4219	0.49	0.92
1223	30495.4	-0.33	3984	0.63	1.03
1233	30554.7	0.98	4227	0.61	1.05
1235	30566.5	0.00	4278	0.54	0.98
1245	30624.2	0.24	4279	0.54	0.98
1253	30671.2	1.18	4125	0.57	0.98
1263	30768.4	0.94	4310	0.51	0.95
1268	30896.8	-1.82	4546	0.33	0.80
1280	31202.7	1.70	4273	0.58	1.02
1540	37481.6	-3.22	3695	0.53	0.80
1546	37550.9	-3.26	3958	0.43	0.73
1603	38201.9	2.04	5181	0.24	0.76
1613	38313.3	0.32	4872	0.24	0.72
1624	38432.8	0.16	5031	0.16	0.67
1626	38457.9	0.50	4779	0.29	0.75
1632	38522.7	1.24	5298	0.14	0.69
1643	38643	0.24	5017	0.17	0.68
1653	38755.5	1.28	5303	0.13	0.68
1659	38822.4	2.16	5447	0.13	0.70
1666	38898.8	2.61	5388	0.16	0.73
1683	39088.6	4.13	5325	0.38	0.91
1766	40010.6	-1.16	4675	0.22	0.69
1777	40128.3	-2.00	4732	0.22	0.69
1785	40213.5	2.35	5305	0.23	0.79
1796	40328.2	0.43	4561	0.38	0.82
2038	43112.3	1.84	4588	0.48	0.90
2501	50103.4	1.86	4626	0.50	0.91
2516	50327.5	1.22	4414	0.52	0.90
2527	50494.6	0.72	4275	0.56	0.92
2537	50644.9	0.96	4163	0.58	0.92
2547	50794.7	0.40	4211	0.53	0.87
2564	51054.1	0.85	4381	0.48	0.85
2621	51917.3	2.53	4784	0.44	0.86
2630	52051.3	-0.20	3822	0.64	0.93
2724	53474.9	-0.59	3636	0.68	0.94
2753	53907.5	3.72	5175	0.38	0.86
2790	54566.8	2.35	4872	0.43	0.86
2924	57094.6	0.23	4142	0.53	0.86
2961	57790.9	-0.03	3209	1.09	1.31
2987	58278.8	0.76	3950	0.72	1.02
3003	58577.4	2.96	4819	0.42	0.85

3005	58615.8	0.26	3705	0.75	1.02
3079	60003.3	1.85	3527	0.85	1.11
3185	61978.6	2.00	3743	0.72	1.01
3319	64182.3	2.50	4358	0.53	0.91
3460	66099.6	2.22	4290	0.47	0.83
3511	66764.1	-0.23	4126	0.48	0.81
3522	66916.3	1.81	3987	0.60	0.91
3538	67125.4	-0.92	3303	0.70	0.90
3558	67390.9	-0.93	3302	0.71	0.92
3567	67520	-0.23	3588	0.63	0.88
3587	67794.3	0.81	3851	0.55	0.84
3595	67904.8	1.99	4227	0.52	0.86
3604	68027.8	-0.91	3441	0.67	0.90
3616	68193.9	1.96	4189	0.53	0.87
3675	69007.2	1.30	3898	0.54	0.83
3685	69145.4	-0.43	3701	0.58	0.84
3705	69417.4	0.02	3725	0.60	0.86
3725	69696.6	1.51	3776	0.62	0.89
3754	70097.5	2.36	4185	0.56	0.89
3779	70400.9	3.96	3554	1.14	1.41
3799	70623	2.10	3833	0.67	0.94
3819	70849.2	2.20	3698	0.74	1.00
3837	71044.4	0.94	3561	0.71	0.94
3858	71279.3	0.91	3516	0.79	1.02
3868	71393	0.60	3591	0.72	0.96
3894	71680.6	-0.91	3221	0.79	0.96
3916	71931	0.62	3606	0.71	0.95
4007	72956.6	3.77	3942	0.96	1.25
4016	73060.4	-2.17	3423	0.74	0.91
4027	73179.3	1.34	3899	0.74	1.01
4033	73247.8	1.08	3632	0.93	1.16
4043	73356.3	1.56	4511	0.47	0.82
4051	73444.2	0.07	3809	0.63	0.88
4063	73581.4	1.91	4236	0.60	0.90
4077	73736.8	-1.21	2691	1.26	1.35
4085	73826.7	2.33	4138	0.68	0.97
4093	73915	-4.08	2455	1.28	1.28
4098	73970.2	1.96	4381	0.65	0.98
4105	74049.2	-4.06	2618	1.20	1.23
4114	74151	0.87	3111	1.24	1.40
4130	74327.6	1.35	3623	0.84	1.06
4146	74502.5	1.54	3556	0.97	1.19
4165	74714.2	-1.57	3717	0.59	0.81

4172	74796	1.69	4326	0.50	0.81
4192	75018.3	-1.95	3925	0.53	0.77
4213	75239.4	-0.48	4090	0.57	0.84
4223	75345.2	-0.57	3531	0.73	0.93
4246	75588.4	1.12	4861	0.28	0.67
4267	75805	-3.34	4359	0.29	0.59
4287	76022.3	-1.48	4393	0.36	0.67
4321	76388.6	-0.71	3898	0.61	0.85
4331	76495.4	-0.79	3679	0.70	0.91
4424	77497.2	0.95	4215	0.52	0.80
4444	77713.4	2.67	4814	0.45	0.82
4466	77950.7	-0.53	3596	0.74	0.93
4484	78145.2	0.07	4118	0.52	0.78
4514	78468.6	1.47	3573	0.77	0.96
4529	78624.9	-0.65	2762	1.12	1.19
4539	78728.2	-0.68	2937	1.02	1.12
4612	79501.5	-0.58	4079	0.58	0.84
4632	79708	1.37	4152	0.63	0.90
4652	79925.7	0.04	4314	0.46	0.75
4726	80714.2	3.08	4173	0.66	0.93
4765	81138.2	5.68	5509	0.30	0.77
4785	81358.7	1.73	4097	0.56	0.82
4809	81623.3	3.37	3899	0.92	1.16
4828	81835	-0.53	3458	0.74	0.90
4924	82893.5	0.46	3684	0.74	0.94
5004	83775.9	2.19	3771	0.89	1.11
5063	84990.7	-1.17	3193	1.03	1.16
5120	86230.5	3.64	4164	0.80	1.07
5161	87105.7	0.53	3784	0.68	0.89
5198	87895.4	2.96	4015	0.72	0.96
5430	93808.8	1.55	4030	0.64	0.89
5473	94979.1	2.84	3639	1.00	1.20
5500	95716.6	1.94	3867	0.91	1.14
5518	96188	2.88	4135	0.89	1.16
5586	98027.5	-3.24	3011	1.04	1.10
5611	98709.7	2.21	3885	0.84	1.06
5657	99962.7	0.22	3781	0.71	0.90
5675	100449.4	1.46	4113	0.66	0.89
5692	100904.9	1.14	3994	0.67	0.89
5724	101773.9	0.61	4567	0.37	0.67
5741	102241.3	-1.09	4108	0.45	0.68
5750	102482.3	0.25	4230	0.53	0.77
5768	102962.7	1.60	4152	0.66	0.89

5871	105756.1	0.98	4641	0.41	0.71
5936	107516.1	1.90	4210	0.66	0.87
5951	107923.1	1.98	4143	0.73	0.94
5979	108683.1	2.30	4279	0.64	0.85
6020	109721.8	0.78	3807	0.75	0.89
6035	110046	1.48	4454	0.53	0.76
6051	110410.7	1.91	4563	0.49	0.74
6066	110749	1.60	4490	0.48	0.71
6096	111417.7	1.25	3921	0.77	0.92
6126	112079.2	2.70	4032	0.62	0.77
6143	112458.6	1.02	3776	0.78	0.91
6175	113175.1	1.37	3957	0.63	0.77
6190	113513	1.03	3897	0.73	0.86
6206	113866.9	1.00	3999	0.71	0.86
6230	114396.6	2.22	3985	0.91	1.06
6260	115062.8	0.59	4593	0.39	0.62
6296	115781.1	0.52	3632	0.80	0.89
6312	116113.1	-0.44	3238	0.92	0.95
6342	116716.3	2.88	3886	0.91	1.05
6380	117485.2	0.12	4133	0.51	0.67
6419	118271.7	1.85	4559	0.43	0.66
6443	118760.7	-0.19	4140	0.48	0.64
6482	119547.2	0.48	3794	0.77	0.89
6515	120190.6	1.14	4525	0.51	0.73
6553	120787	1.05	4566	0.47	0.69
6606	121607.2	-0.14	3995	0.62	0.77
6649	122274.4	2.57	4498	0.66	0.87
6675	122671.2	2.95	3956	0.93	1.08
6693	122942.9	0.91	4494	0.48	0.70
6711	123213.8	0.50	4224	0.55	0.73
6721	123363.9	3.41	4294	0.73	0.92
6735	123573.2	-0.81	4559	0.22	0.47
6827	124848.8	3.32	4448	0.68	0.90
6847	125110	3.04	4721	0.53	0.79
6854	125205.7	2.60	4091	0.77	0.95
6874	125476.3	3.84	4662	0.63	0.88
6897	125785.6	1.02	4244	0.62	0.82
6911	125975.8	2.17	4032	0.88	1.06
6912	125989.1	2.33	4568	0.54	0.79
6923	126136.8	0.27	4026	0.67	0.84
6935	126303.9	2.56	4481	0.59	0.83
6942	126390.5	2.03	4401	0.57	0.79
6946	126448.8	2.31	4426	0.53	0.75

6961	126654	1.25	4162	0.65	0.84
6964	126690.4	2.67	4647	0.55	0.81
6968	126747.1	1.53	4535	0.47	0.71
6982	126937	-0.64	4216	0.46	0.65
6985	126980.1	2.81	4568	0.45	0.70
6991	127060.4	4.57	5406	0.33	0.70
7006	127265.1	5.10	5725	0.24	0.67
7021	127457.6	3.51	5255	0.34	0.69
7025	127505.4	2.97	5127	0.36	0.69
7028	127541.7	3.47	5403	0.26	0.64
7029	127553.3	4.17	5223	0.36	0.71
7039	127678.4	4.39	4558	0.69	0.95
7050	127814.3	3.75	4648	0.60	0.87
7067	128021	1.57	4314	0.60	0.81
7071	128071.6	2.85	4226	0.73	0.94
7075	128117.9	2.44	3973	0.85	1.03
7082	128204	2.17	3931	0.87	1.04
7086	128253.7	1.88	4408	0.57	0.81
7093	128341.2	1.87	4357	0.62	0.84
7097	128392.1	5.43	5627	0.34	0.75
7132	128828.1	1.01	4281	0.48	0.70
7142	128949.6	1.92	4381	0.56	0.79
7147	129007.1	2.01	4652	0.48	0.75
7152	129070.4	3.31	4609	0.59	0.85
7163	129202.7	3.44	4386	0.67	0.90
7173	129328.7	1.23	4427	0.53	0.78
7178	129389.1	1.93	3920	0.85	1.03
7185	129476.1	2.56	4237	0.80	1.02
7189	129526.9	2.30	3885	0.83	1.00
7214	129828.4	0.94	4052	0.64	0.83
7224	129954.4	0.09	3689	0.82	0.97
7234	130075.3	0.23	3784	0.75	0.91
7245	130212.2	3.75	4165	0.92	1.14
7259	130382.3	1.52	3954	0.75	0.94
7264	130454.1	3.52	4269	0.71	0.94
7295	130909.1	2.14	4166	0.79	1.01
7304	131044	1.68	4058	0.72	0.92
7309	131118.7	3.26	4004	0.89	1.09
7314	131192.4	1.03	3949	0.76	0.95
7319	131270.6	3.37	4519	0.65	0.92

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1132 SI Table 5: Definition of the Marine Isotope Stages (and sub-stages) boundaries used

1133 in our analyses.

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Age (ka)	Marine Isotope Stage		Source
132.7 - 130	MIS 6		Lisiecki and Raymo, 2005
130 - 71	MIS 5		Martrat et al., 2004
127 - 112		MIS 5e	Rasmussen et al., 2014
112 - 109		MIS 5d	
109 - 94		MIS 5c	
94 - 86		MIS 5b	
86 - 71		MIS 5a	
71 - 57	MIS 4		
57 - 29	MIS 3		
29 - 14	MIS 2		
14 - present time	MIS 1		

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