

Supplementary Figures

Figure S1. Schematic of the data inputs and processing steps used to create and evaluate the Biogenic Emissions Landuse Dataset (BELD) version 4.

Figure S2. Vegetation fraction for aggregated oak and needle leaf vegetation from BELD3 (left) and BELD4 (right). Field study locations shown with red circles.

Figure S3. Distribution of hourly temperatures at the Cool and Sacramento sites during the 2009 and 2010 field campaign periods.

Figure S4. Hourly observed and modeled temperature at the core field study sites during the 2009 period.

14

15 Figure S5. Hourly observed and modeled temperature at Ameriflux tower sites in northern California
16 during the 2009 period. <http://ameriflux.lbl.gov/>

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18 Figure S6. Hourly observed and modeled shortwave downward radiation at Ameriflux tower sites in
19 northern California during the 2009 period. <http://ameriflux.lbl.gov/>

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21 Figure S7. Modeled and measured isoprene, methacrolein+methyl vinyl ketones, and MPAN at Blodgett
22 Forest.

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24 **Supplementary Table**

25 Table S1. FIA to BELD4 mapping scheme.

| FIA.Name | BELD.Name | BEIS.BM |
|----------------------|------------------|----------------|
| Abies.amabilis | Fir_Pacf_silver | 1500 |
| Abies.balsamea | Fir_balsam | 1500 |
| Abies.bracteata | Fir_SantaLucia | 1500 |
| Abies.concolor | Fir_white | 1500 |
| Abies.fraseri | Fir_fraser | 1500 |
| Abies.grandis | Fir_grand | 1500 |
| Abies.lasiocarpa | Fir_corkbark | 1500 |
| Abies.magnifica | Fir_CA_red | 1500 |
| Abies.procera | Fir_noble | 1500 |
| Abies.shastensis | Fir_Shasta_red | 1500 |
| Abies.spp. | Fir_spp | 1500 |
| Acacia.farnesiana | Acacia | 700 |
| Acer.barbatum | Maple_FL | 375 |
| Acer.glabrum | Maple_RkyMtn | 375 |
| Acer.grandidentatum | Maple_bigleaf | 375 |
| Acer.leucoderme | Maple_spp | 375 |
| Acer.macrophyllum | Maple_bigtooth | 375 |
| Acer.negundo | Maple_boxelder | 375 |
| Acer.nigrum | Maple_black | 375 |
| Acer.pensylvanicum | Maple_stripped | 375 |
| Acer.platanoides | Maple_Norway | 375 |
| Acer.rubrum | Maple_red | 375 |
| Acer.saccharinum | Maple_silver | 375 |
| Acer.saccharum | Maple_sugar | 375 |
| Acer.spicatum | Maple_mtn | 375 |
| Acer.spp. | Maple_spp | 375 |
| Aesculus.californica | Chestnut_buckeye | 375 |
| Aesculus.flava | Chestnut_buckeye | 375 |
| Aesculus.glabra | Chestnut_buckeye | 375 |
| Aesculus.glabra | Chestnut_buckeye | 375 |
| Aesculus.pavia | Chestnut_buckeye | 375 |
| Aesculus.spp. | Chestnut_buckeye | 375 |
| Aesculus.sylvatica | Chestnut_buckeye | 375 |
| Ailanthus.altissima | Ailanthus | 375 |
| Albizia.julibrissin | Spruce_spp | 1500 |
| Alnus.glutinosa | Alder | 375 |
| Alnus.oblongifolia | Alder | 375 |
| Alnus.rhombifolia | Alder | 375 |
| Alnus.rubra | Alder | 375 |

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|---------------------------------|----------------|------|
| Amelanchier.arborea | Serviceberry | 375 |
| Amelanchier.sanguinea | Serviceberry | 375 |
| Amelanchier.spp. | Serviceberry | 375 |
| Annona.glabra | Misc-hardwoods | 375 |
| Arbutus.arizonica | Madrone | 375 |
| Arbutus.menziesii | Madrone | 375 |
| Arbutus.xalapensis | Madrone | 375 |
| Asimina.triloba | Pawpaw | 375 |
| Avicennia.germinans | Misc-hardwoods | 375 |
| Betula.alleghaniensis | Birch | 375 |
| Betula.lenta | Birch | 375 |
| Betula.nigra | Birch | 375 |
| Betula occidentalis | Birch | 375 |
| Betula.papyrifera | Birch | 375 |
| Betula.populifolia | Birch | 375 |
| Betula.spp. | Birch | 375 |
| Bursera.simaruba | Oak_spp | 375 |
| Calocedrus.decurrens | Incense_cedar | 1500 |
| Carpinus.caroliniana | Hornbeam | 375 |
| Carya.alba | Hickory | 375 |
| Carya.aquatica | Hickory | 375 |
| Carya.carolinae.septentrionalis | Hickory | 375 |
| Carya.cordiformis | Hickory | 375 |
| Carya.glabra | Hickory | 375 |
| Carya.illinoensis | Hickory | 375 |
| Carya.laciniosa | Hickory | 375 |
| Carya.myristiciformis | Hickory | 375 |
| Carya.ovalis | Hickory | 375 |
| Carya.ovata | Hickory | 375 |
| Carya.pallida | Hickory | 375 |
| Carya.spp. | Hickory | 375 |
| Carya.texana | Hickory | 375 |
| Castanea.dentata | Castanea | 375 |
| Castanea.mollissima | Castanea | 375 |
| Castanea.pumila | Castanea | 375 |
| Castanea.pumila | Castanea | 375 |
| Castanea.spp. | Castanea | 375 |
| Casuarina.lepidophloia | Oak_spp | 375 |
| Catalpa.bignonioides | Catalpa | 375 |
| Catalpa.speciosa | Catalpa | 375 |
| Catalpa.spp. | Catalpa | 375 |
| Celtis.laevigata | Hackberry | 375 |
| Celtis.occidentalis | Hackberry | 375 |

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|-----------------------------------|-----------------|------|
| Celtis.spp. | Hackberry | 375 |
| Cercis.canadensis | Redbay | 375 |
| Cercocarpus.ledifolius | Mahogany | 375 |
| Chamaecyparis.lawsoniana | Cedar_chamaecyp | 1500 |
| Chamaecyparis.nootkatensis | Cedar_chamaecyp | 1500 |
| Chamaecyparis.thyoides | Cedar_chamaecyp | 1500 |
| Chrysolepis.chrysophylla | Misc-hardwoods | 375 |
| Cinnamomum.camphora | Misc-hardwoods | 375 |
| Citrus.spp. | Misc-hardwoods | 375 |
| Cladrastis.kentukea | Yellowwood | 375 |
| Coccoloba.diversifolia | Misc-hardwoods | 375 |
| Coccothrinax.argentata | Misc-hardwoods | 375 |
| Condalia.hookeri | Spruce_spp | 1500 |
| Conocarpus.erectus | Misc-hardwoods | 375 |
| Cordia.sebestena | Misc-hardwoods | 375 |
| Cornus.florida | Dogwood | 375 |
| Cornus.nuttallii | Dogwood | 375 |
| Cotinus.obovatus | Smoketree | 375 |
| Crataegus.crus.galli | Hawthorn | 375 |
| Crataegus.mollis | Hawthorn | 375 |
| Crataegus.spp. | Hawthorn | 375 |
| Cupressus.arizonica | Cypress_cupress | 375 |
| Cupressus.bakeri | Cypress_cupress | 375 |
| Cupressus.macrocarpa | Cypress_cupress | 375 |
| Cupressus.sargentii | Cypress_cupress | 375 |
| Cupressus.spp. | Cypress_cupress | 375 |
| Diospyros.spp. | Persimmon | 375 |
| Diospyros.texana | Persimmon | 375 |
| Diospyros.virginiana | Persimmon | 375 |
| Ebenopsis.ebano | Misc-hardwoods | 375 |
| Ehretia.anacua | Misc-hardwoods | 375 |
| Elaeagnus.angustifolia | Misc-hardwoods | 375 |
| Eucalyptus.globulus | Eucalyptus | 375 |
| Eucalyptus.grandis | Eucalyptus | 375 |
| Eucalyptus.spp. | Eucalyptus | 375 |
| Fagus.grandifolia | Beech | 375 |
| Family.Arecaceae.not.listed.above | Misc-hardwoods | 375 |
| Ficus.aurea | Spruce_spp | 1500 |
| Fraxinus.americana | Ash | 375 |
| Fraxinus.caroliniana | Ash | 375 |
| Fraxinus.latifolia | Ash | 375 |
| Fraxinus.nigra | Ash | 375 |
| Fraxinus.pennsylvanica | Ash | 375 |

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|-------------------------|------------------|-----|
| Fraxinus.profunda | Ash | 375 |
| Fraxinus.quadrangulata | Ash | 375 |
| Fraxinus.spp. | Ash | 375 |
| Fraxinus.texensis | Ash | 375 |
| Fraxinus.velutina | Ash | 375 |
| Ginkgo.biloba | Misc-hardwoods | 375 |
| Gleditsia.aquatica | Gleditsia_locust | 375 |
| Gleditsia.spp. | Gleditsia_locust | 375 |
| Gleditsia.triacanthos | Gleditsia_locust | 375 |
| Gordonia.lasianthus | Loblolly_bay | 375 |
| Guapira.discolor | Misc-hardwoods | 375 |
| Gymnocladus.dioicus | KY_coffeetree | 375 |
| Halesia.carolina | Silverbell | 375 |
| Halesia.diptera | Silverbell | 375 |
| Halesia.spp. | Silverbell | 375 |
| Ilex.opaca | Holly_American | 375 |
| Juglans.californica | Walnut | 375 |
| Juglans.cinerea | Walnut | 375 |
| Juglans.hindsii | Walnut | 375 |
| Juglans.major | Walnut | 375 |
| Juglans.microcarpa | Walnut | 375 |
| Juglans.nigra | Walnut | 375 |
| Juglans.spp. | Walnut | 375 |
| Juniperus.ashei | Juniper | 700 |
| Juniperus.californica | Juniper | 700 |
| Juniperus.coahuilensis | Juniper | 700 |
| Juniperus.deppeana | Juniper | 700 |
| Juniperus.flaccida | Juniper | 700 |
| Juniperus.monosperma | Juniper | 700 |
| Juniperus.occidentalis | Juniper | 700 |
| Juniperus.osteosperma | Juniper | 700 |
| Juniperus.pinchotii | Juniper | 700 |
| Juniperus.scopulorum | Juniper | 700 |
| Juniperus.spp. | Juniper | 700 |
| Juniperus.virginiana | Juniper | 700 |
| Laguncularia.racemosa | Misc-hardwoods | 375 |
| Larix.laricina | Larch | 375 |
| Larix.lyallii | Larch | 375 |
| Larix.occidentalis | Larch | 375 |
| Larix.spp. | Larch | 375 |
| Leucaena.pulverulenta | Misc-hardwoods | 375 |
| Liquidambar.styraciflua | Sweetgum | 375 |
| Liriodendron.tulipifera | Yellow_poplar | 375 |

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|-------------------------|------------------|------|
| Lithocarpus.densiflorus | Tanoak | 375 |
| Maclura.pomifera | Osage-orange | 375 |
| Magnolia.acuminata | Magnolia | 375 |
| Magnolia.fraseri | Magnolia | 375 |
| Magnolia.grandiflora | Magnolia | 375 |
| Magnolia.macrophylla | Magnolia | 375 |
| Magnolia.spp. | Magnolia | 375 |
| Magnolia.tripetala | Magnolia | 375 |
| Magnolia.virginiana | Magnolia | 375 |
| Malus.angustifolia | Apple | 375 |
| Malus.coronaria | Apple | 375 |
| Malus.fusca | Apple | 375 |
| Malus.ioensis | Apple | 375 |
| Malus.spp. | Apple | 375 |
| Melaleuca.quinquenervia | Cajeput | 375 |
| Melia.azedarach | Chinaberry | 375 |
| Metopium.toxiferum | Misc-hardwoods | 375 |
| Morus.alba | Mulberry | 375 |
| Morus.microphylla | Mulberry | 375 |
| Morus.rubra | Mulberry | 375 |
| Morus.spp. | Mulberry | 375 |
| Nyssa.aquatica | Nyssa | 375 |
| Nyssa.biflora | Nyssa | 375 |
| Nyssa.ogeche | Nyssa | 375 |
| Nyssa.sylvatica | Nyssa | 375 |
| Olneya.tesota | Robinia_locust | 375 |
| Ostrya.virginiana | East_hophornbean | 375 |
| Oxydendrum.arboreum | Sourwood | 375 |
| Paulownia.tomentosa | Paulownia | 375 |
| Persea.borbonia | Misc-hardwoods | 375 |
| Eugenia.rhombea | Misc-hardwoods | 375 |
| Persea.spp. | Misc-hardwoods | 375 |
| Picea.abies | Spruce_Norway | 1500 |
| Picea.breweriana | Spruce_Brewer | 1500 |
| Picea.engelmannii | Spruce_Engelmann | 1500 |
| Picea.glauca | Spruce_white | 1500 |
| Picea.mariana | Spruce_black | 1500 |
| Picea.pungens | Spruce_blue | 1500 |
| Picea.rubens | Spruce_red | 1500 |
| Picea.sitchensis | Spruce_Sitka | 1500 |
| Picea.spp. | Spruce_spp | 1500 |
| Pinus.albicaulis | Pine_whitebark | 700 |
| Pinus.aristata | Pine_brstlcone | 700 |

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|-----------------------|------------------|-----|
| Pinus.arizonica | Pine_AZ | 700 |
| Pinus.attenuata | Pine_knobcone | 700 |
| Pinus.balfouriana | Pine_foxtail | 700 |
| Pinus.banksiana | Pine_jack | 700 |
| Pinus.cembroides | Pine_pinyon | 700 |
| Pinus.clausa | Pine_sand | 700 |
| Pinus.contorta | Pine_lodgepole | 700 |
| Pinus.coulteri | Pine_Coulter | 700 |
| Pinus.discolor | Pine_pinyon_brdr | 700 |
| Pinus.echinata | Pine_shortleaf | 700 |
| Pinus.edulis | Pine_pinyon_cmn | 700 |
| Pinus.elliottii | Pine_slash | 700 |
| Pinus.engelmannii | Pine_Apache | 700 |
| Pinus.flexilis | Pine_limber | 700 |
| Pinus.glabra | Pine_spruce | 700 |
| Pinus.jeffreyi | Pine_Jeffrey | 700 |
| Pinus.lambertiana | Pine_sugar | 700 |
| Pinus.leiophylla | Pine_chihuahua | 700 |
| Pinus.longaeva | Pine_brstlccone | 700 |
| Pinus.monophylla | Pine_pinyon | 700 |
| Pinus.monticola | Pine_Wwhite | 700 |
| Pinus.muricata | Pine_Bishop | 700 |
| Pinus.nigra | Pine_Austrian | 700 |
| Pinus.palustris | Pine_longleaf | 700 |
| Pinus.ponderosa | Pine_ponderosa | 700 |
| Pinus.pungens | Pine_tablemtn | 700 |
| Pinus.radiata | Pine_Monterey | 700 |
| Pinus.remota | Pine_pinyon | 700 |
| Pinus.resinosa | Pine_red | 700 |
| Pinus.rigida | Pine_pitch | 700 |
| Pinus.sabiniana | Pine_digger | 700 |
| Pinus.serotina | Pine_pond | 700 |
| Pinus.spp. | Pine_pinyon | 700 |
| Pinus.strobiformis | Pine_Swwhite | 700 |
| Pinus.strobus | Pine_Ewhite | 700 |
| Pinus.sylvestris | Pine_scotch | 700 |
| Pinus.taeda | Pine_loblolly | 700 |
| Pinus.virginiana | Pine_VA | 700 |
| Pinus.washoensis | Pine_Washoe | 700 |
| Piscidia.piscipula | Misc-hardwoods | 375 |
| Planera.aquatica | Water-elm | 375 |
| Platanus.occidentalis | Sycamore | 375 |
| Platanus.racemosa | Sycamore | 375 |

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|------------------------|-----------------|------|
| Platanus.spp. | Sycamore | 375 |
| Platanus.wrightii | Sycamore | 375 |
| Populus.alba | Populus | 375 |
| Populus.angustifolia | Populus | 375 |
| Populus.balsamifera | Populus | 375 |
| Populus.deltoides | Populus | 375 |
| Populus.fremontii | Populus | 375 |
| Populus.grandidentata | Populus | 375 |
| Populus.heterophylla | Populus | 375 |
| Populus.nigra | Populus | 375 |
| Populus.spp. | Populus | 375 |
| Populus.tremuloides | Populus | 375 |
| Prosopis.glandulosa | Mesquite | 375 |
| Prosopis.pubescens | Mesquite | 375 |
| Prosopis.spp. | Mesquite | 375 |
| Prosopis.velutina | Mesquite | 375 |
| Prunus.americana | Prunus | 375 |
| Prunus.avium | Prunus | 375 |
| Prunus.cerasus | Prunus | 375 |
| Prunus.emarginata | Prunus | 375 |
| Prunus.nigra | Prunus | 375 |
| Prunus.pensylvanica | Prunus | 375 |
| Prunus.persica | Prunus | 375 |
| Prunus.serotina | Prunus | 375 |
| Prunus.spp. | Prunus | 375 |
| Prunus.virginiana | Prunus | 375 |
| Pseudotsuga.macrocarpa | Douglas_fir | 1500 |
| Pseudotsuga.menziesii | Douglas_fir | 1500 |
| Quercus.agrifolia | Oak_CA_live | 375 |
| Quercus.alba | Oak_white | 375 |
| Quercus.arizonica | Oak_AZ_white | 375 |
| Quercus.bicolor | Oak_swamp_white | 375 |
| Quercus.buckleyi | Oak_spp | 375 |
| Quercus.chrysolepis | Oak_canyon_live | 375 |
| Quercus.coccinea | Oak_scarlet | 375 |
| Quercus.douglasii | Oak_blue | 375 |
| Quercus.ellipsoidalis | Oak_Northrn_pin | 375 |
| Quercus.emoryi | Oak_Emercy | 375 |
| Quercus.engelmannii | Oak_Engelmann | 375 |
| Quercus.falcata | Oak_Southrn_red | 375 |
| Quercus.gambelii | Oak_Gambel | 375 |
| Quercus.garryana | Oak_OR_white | 375 |
| Quercus.graciliformis | Oak_spp | 375 |

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|------------------------|------------------|-----|
| Quercus.gravesii | Oak_spp | 375 |
| Quercus.grisea | Oak_spp | 375 |
| Quercus.hypoleucoides | Oak_silverleaf | 375 |
| Quercus.ilicifolia | Oak_bear | 375 |
| Quercus.imbricaria | Oak_shingle | 375 |
| Quercus.incana | Oak_bluejack | 375 |
| Quercus.kelloggii | Oak_CA_black | 375 |
| Quercus.laceyi | Oak_spp | 375 |
| Quercus.laevis | Oak_turkey | 375 |
| Quercus.laurifolia | Oak_laurel | 375 |
| Quercus.lobata | Oak_CA_white | 375 |
| Quercus.lyrata | Oak_overcup | 375 |
| Quercus.macrocarpa | Oak_bur | 375 |
| Quercus.margarettae | Oak_spp | 375 |
| Quercus.marilandica | Oak_blackjack | 375 |
| Quercus.michauxii | Oak_swamp_cnut | 375 |
| Quercus.minima | Oak_spp | 375 |
| Quercus.muehlenbergii | Oak_chinkapin | 375 |
| Quercus.nigra | Oak_water | 375 |
| Quercus.oblongifolia | Oak_Mexicanblue | 375 |
| Quercus.oglethorpensis | Oak_spp | 375 |
| Quercus.pagoda | Oak_spp | 375 |
| Quercus.palustris | Oak_pin | 375 |
| Quercus.phellos | Oak_willow | 375 |
| Quercus.prinoides | Oak_spp | 375 |
| Quercus.prinus | Oak_chestnut | 375 |
| Quercus.rubra | Oak_Northrn_red | 375 |
| Quercus.rugosa | Oak_spp | 375 |
| Quercus.shumardii | Oak_Shumrd_red | 375 |
| Quercus.similis | Oak_spp | 375 |
| Quercus.sinuata | Oak_Durand | 375 |
| Quercus.spp. | Oak_spp | 375 |
| Quercus.stellata | Oak_post | 375 |
| Quercus.texana | Oak_nuttall | 375 |
| Quercus.velutina | Oak_black | 375 |
| Quercus.virginiana | Oak_live | 375 |
| Quercus.wislizeni | Oak_interio_live | 375 |
| Rhizophora.mangle | Misc-hardwoods | 375 |
| Robinia.pseudoacacia | Robinia_locust | 375 |
| Roystonea.spp. | Misc-hardwoods | 375 |
| Sabal.palmetto | Misc-hardwoods | 375 |
| Salix.alba | Willow | 375 |
| Salix.amygdaloides | Willow | 375 |

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|--------------------------|------------------|------|
| Salix.bebbiana | Willow | 375 |
| Salix.caroliniana | Willow | 375 |
| Salix.nigra | Willow | 375 |
| Salix.pyrifolia | Willow | 375 |
| Salix.sepulcralis | Willow | 375 |
| Salix.spp. | Willow | 375 |
| Sapindus.saponaria | Soapberry_westrn | 375 |
| Sassafras.albidum | Sassafras | 375 |
| Sequoia.sempervirens | Sequoia | 1500 |
| Sequoiadendron.giganteum | Sequoia | 1500 |
| Sideroxylon.lanuginosum | Bumelia_gum | 375 |
| Sideroxylon.salicifolium | Bumelia_gum | 375 |
| Sophora.affinis | Robinia_locust | 375 |
| Sorbus.americana | Mountain_ash | 375 |
| Sorbus.aucuparia | Mountain_ash | 375 |
| Sorbus.decora | Mountain_ash | 375 |
| Sorbus.spp. | Mountain_ash | 375 |
| Swietenia.mahagoni | Misc-hardwoods | 375 |
| Syzygium.cumini | Misc-hardwoods | 375 |
| Tamarix.spp. | Tamarix | 375 |
| Taxodium.ascendens | Cypress_taxodium | 375 |
| Taxodium.distichum | Cypress_taxodium | 375 |
| Taxus.brevifolia | Misc-hardwoods | 375 |
| Thrinax.morrisii | Willow | 375 |
| Thuja.occidentalis | Cedar_thuja | 1500 |
| Thuja.plicata | Cedar_thuja | 1500 |
| Tilia.americana | Basswood | 375 |
| Tilia.spp. | Basswood | 375 |
| Torreya.californica | Torreya | 375 |
| Tree.broadleaf | Misc-hardwoods | 375 |
| Tree.evergreen | Mixed_conifer_sp | 700 |
| Tree.unknown | Misc-hardwoods | 375 |
| Triadica.sebifera | Tallowtree-chins | 375 |
| Tsuga.canadensis | Hemlock | 700 |
| Tsuga.caroliniana | Hemlock | 700 |
| Tsuga.heterophylla | Hemlock | 700 |
| Tsuga.mertensiana | Hemlock | 700 |
| Tsuga.spp. | Hemlock | 700 |
| Ulmus.alata | Elm | 375 |
| Ulmus.americana | Elm | 375 |
| Ulmus.crassifolia | Elm | 375 |
| Ulmus.pumila | Elm | 375 |
| Ulmus.rubra | Elm | 375 |

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|----|--------------------------|----------------|-----|
| | Ulmus.serotina | Elm | 375 |
| | Ulmus.spp. | Elm | 375 |
| | Ulmus.thomasii | Elm | 375 |
| | Umbellularia.californica | Califor-laurel | 375 |
| | Vernicia.fordii | Tung-oil-tree | 375 |
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| 30 | | | |