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EGU 2020 Session CL1.20: Historical climatology and hydrology: the role of documentary evidence in the reconstruction of past (hydro)climate and its variabilities

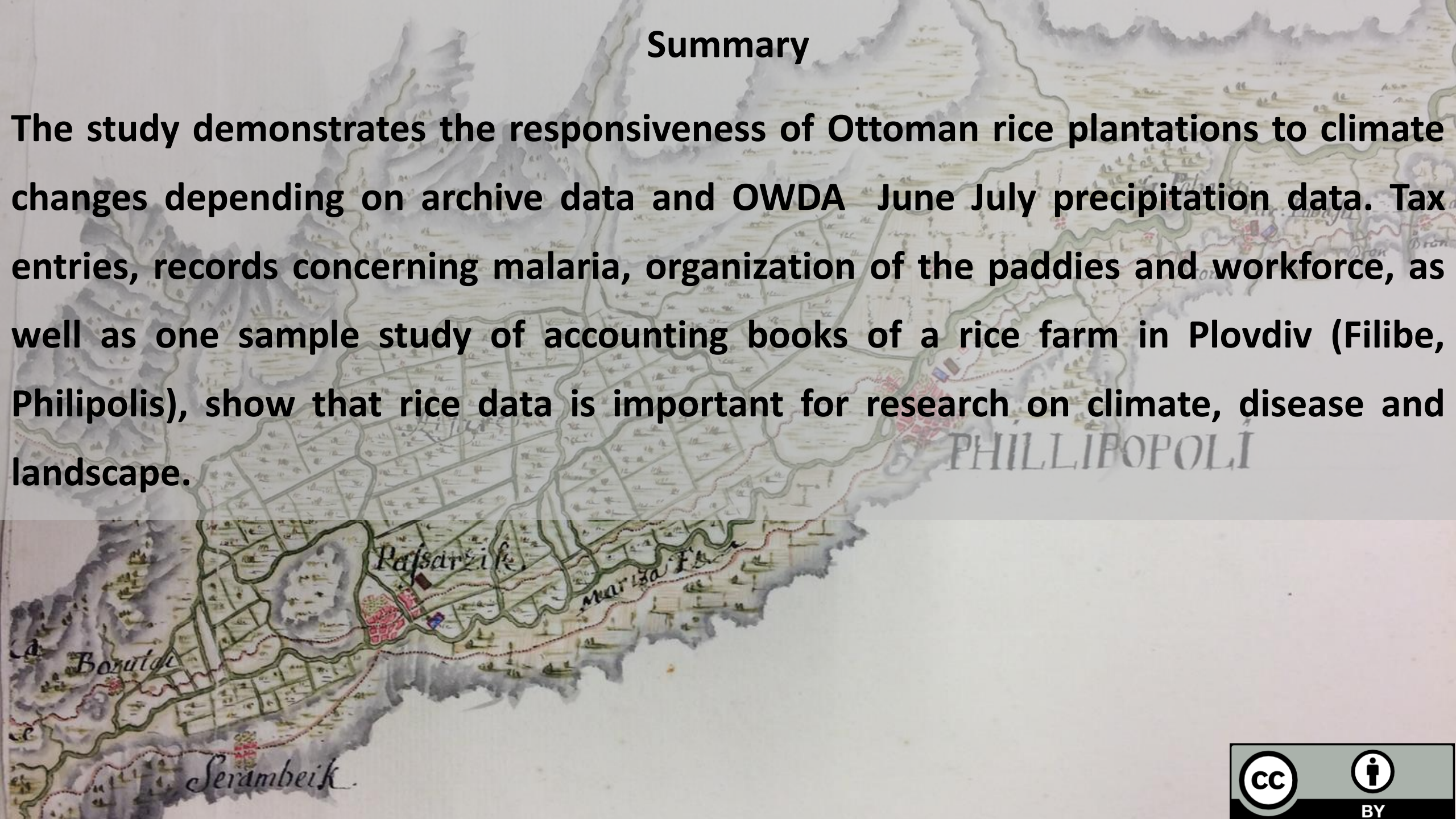


HACETTEPE UNIVERSITY



Summary

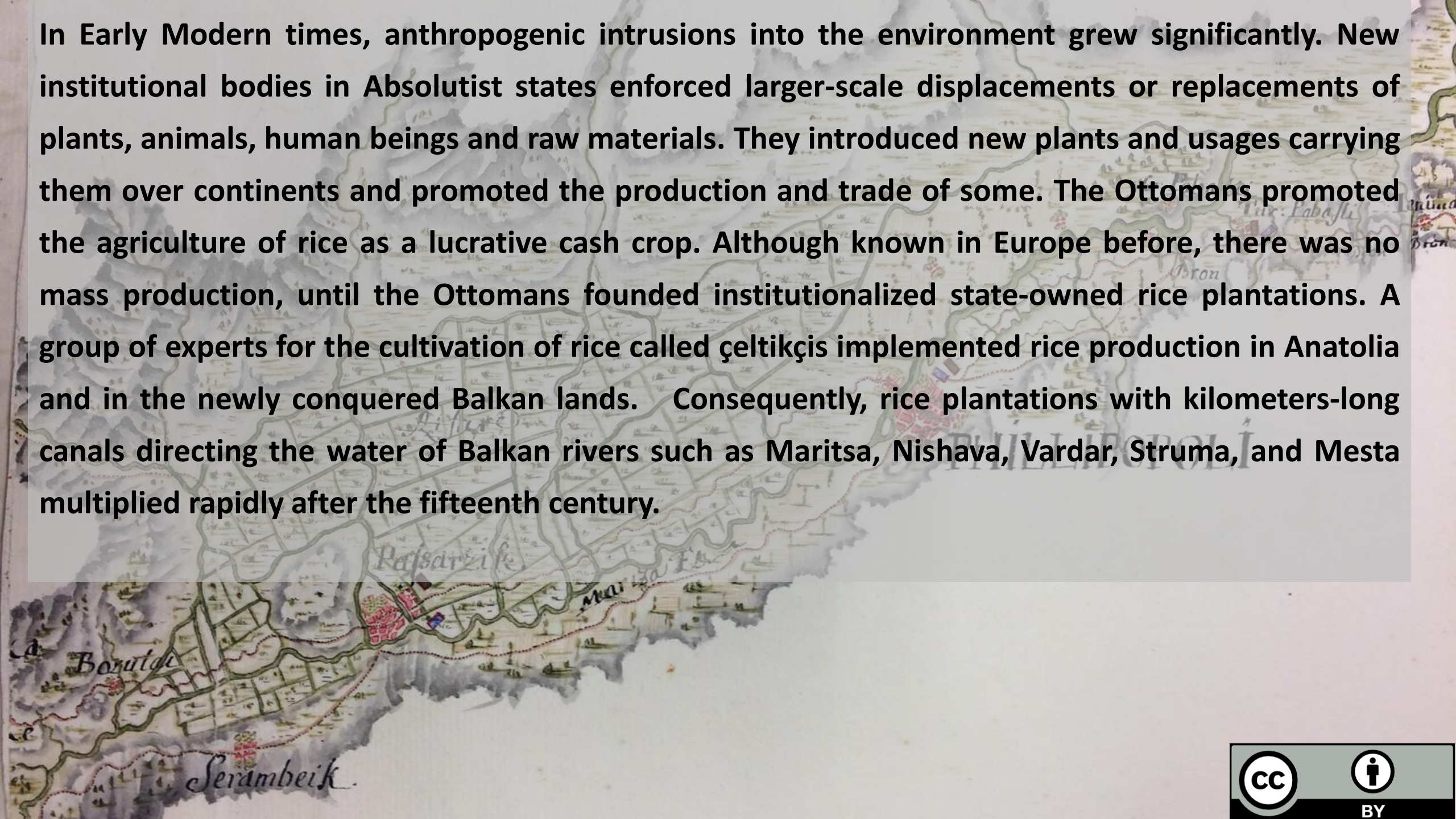
The study demonstrates the responsiveness of Ottoman rice plantations to climate changes depending on archive data and OWDA June July precipitation data. Tax entries, records concerning malaria, organization of the paddies and workforce, as well as one sample study of accounting books of a rice farm in Plovdiv (Filibe, Philipopolis), show that rice data is important for research on climate, disease and landscape.





The story of rice in the Ottoman Balkans is an entangled history of living beings, water, land, and the climate in Southeast Europe and the Middle East.

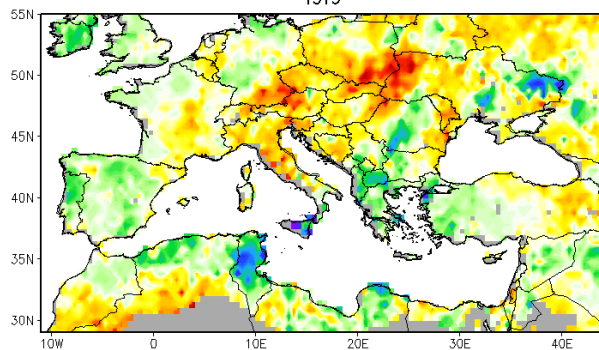
In Early Modern times, anthropogenic intrusions into the environment grew significantly. New institutional bodies in Absolutist states enforced larger-scale displacements or replacements of plants, animals, human beings and raw materials. They introduced new plants and usages carrying them over continents and promoted the production and trade of some. The Ottomans promoted the agriculture of rice as a lucrative cash crop. Although known in Europe before, there was no mass production, until the Ottomans founded institutionalized state-owned rice plantations. A group of experts for the cultivation of rice called *çeltikçis* implemented rice production in Anatolia and in the newly conquered Balkan lands. Consequently, rice plantations with kilometers-long canals directing the water of Balkan rivers such as Maritsa, Nishava, Vardar, Struma, and Mesta multiplied rapidly after the fifteenth century.



Rice production had a fundamental social and environmental impact: Manpower had to be organized on a large scale; land reclamations, deforestation, and kilometres-long irrigation work changed the landscape, produced seasonal miasma and aquatic pests. The organization of the canals was an intrusion into the environment. Both deforestation and the muddy ground along the paddies was an invitation for mosquitos as the vectors carrying malaria. Farmers left their villages. Workforce became the most urgent problem in rice farms by the nineteenth century.

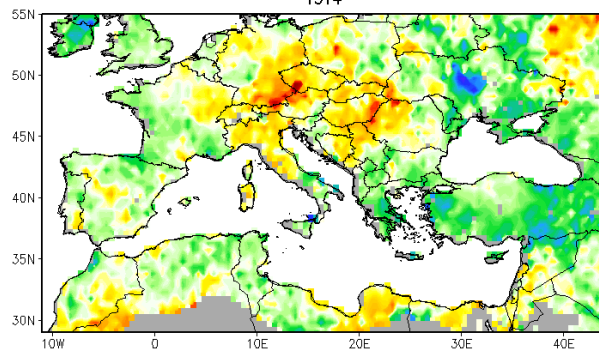
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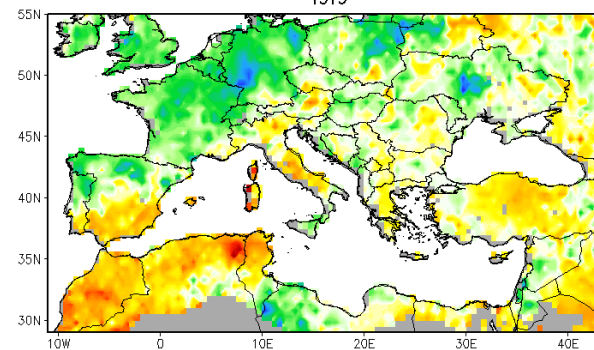
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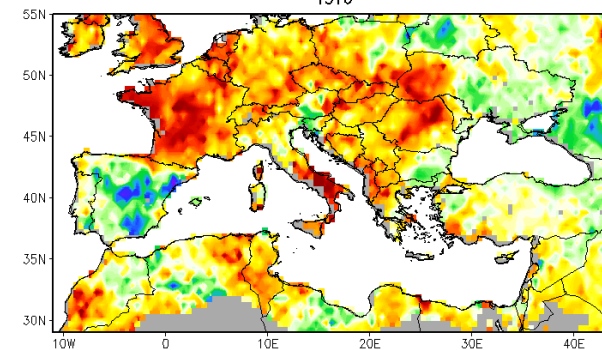
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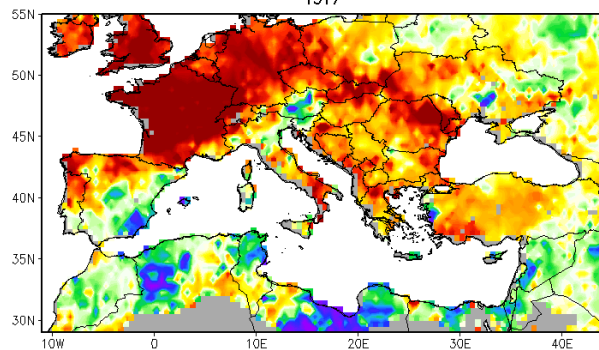
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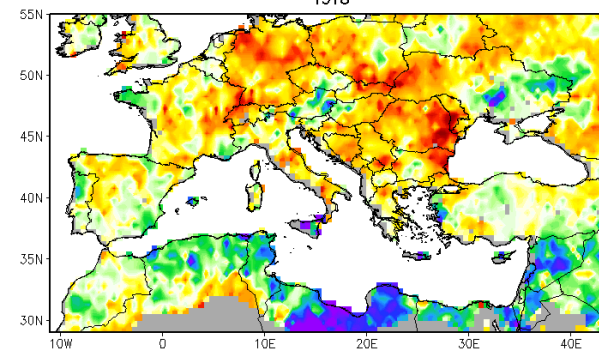
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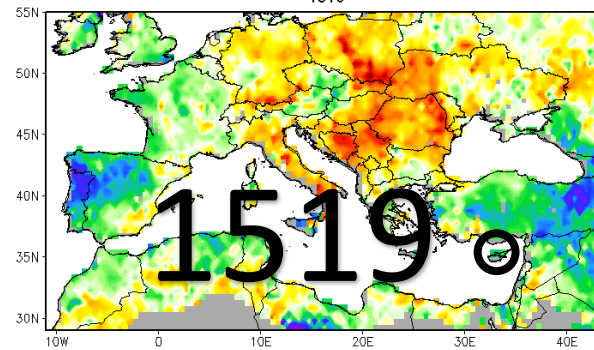
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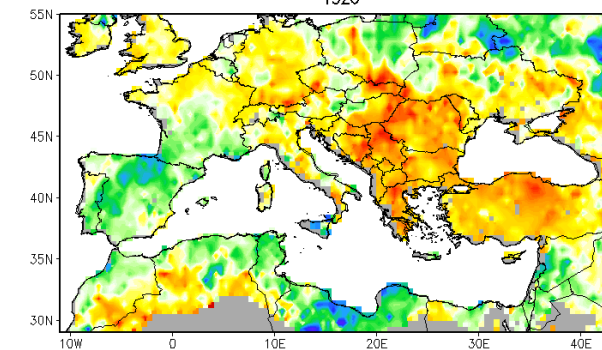
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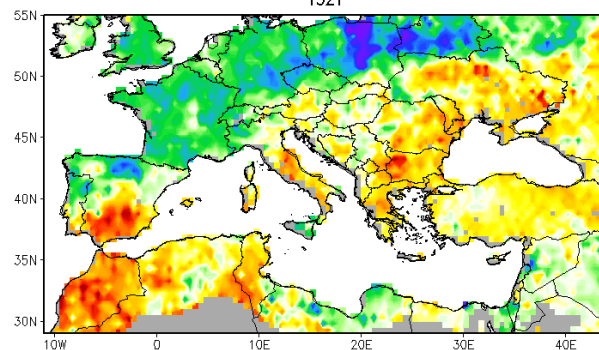
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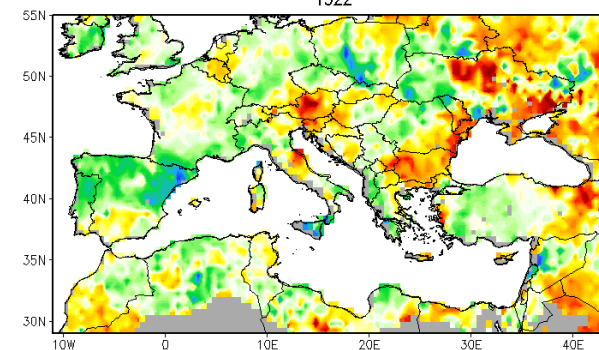
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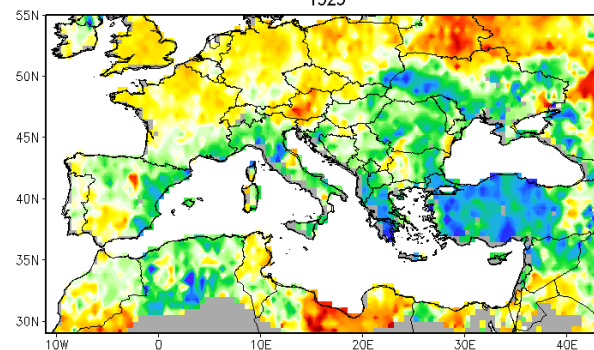
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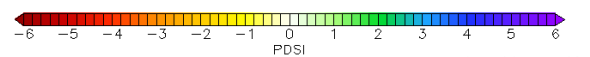
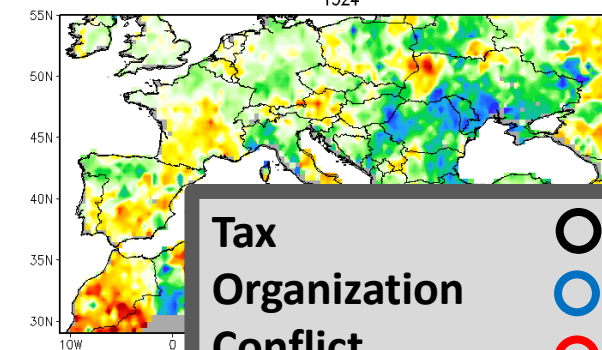
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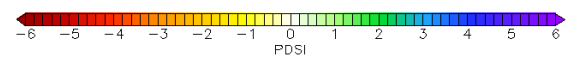
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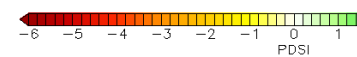
PDSI

drought.memphis

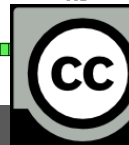


PDSI

drought.memph



PDSI

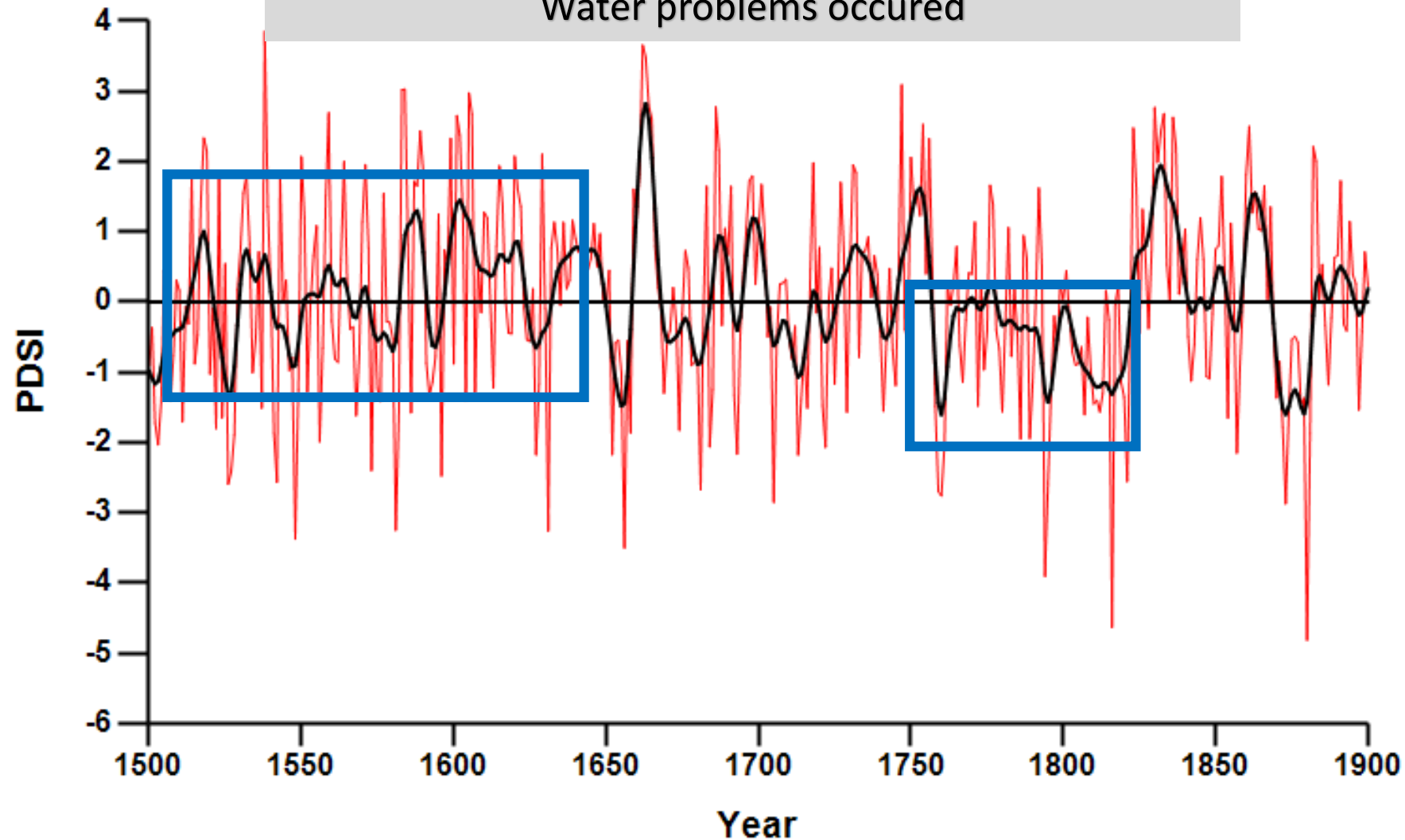


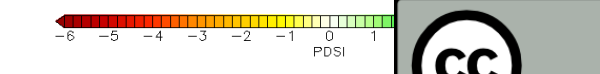
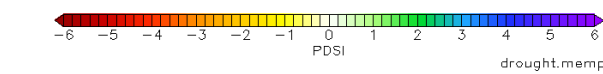
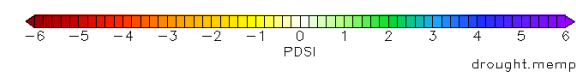
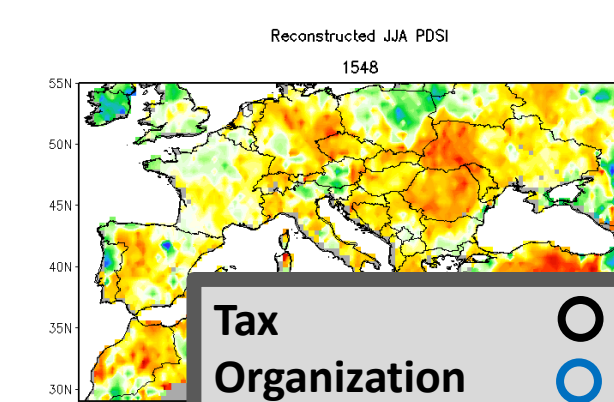
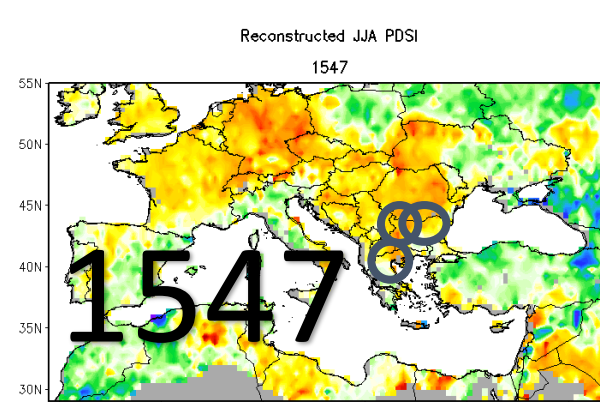
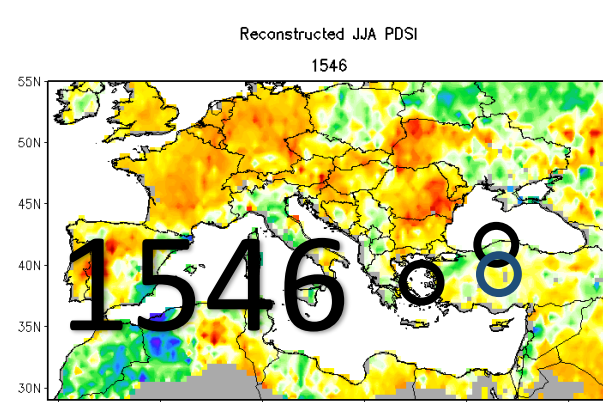
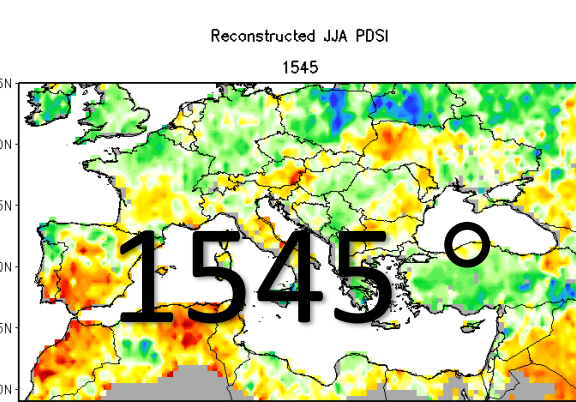
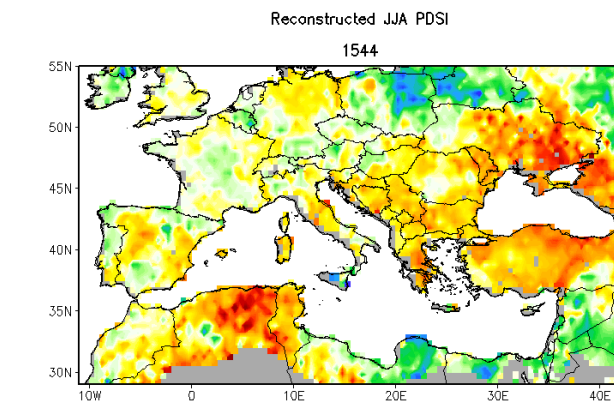
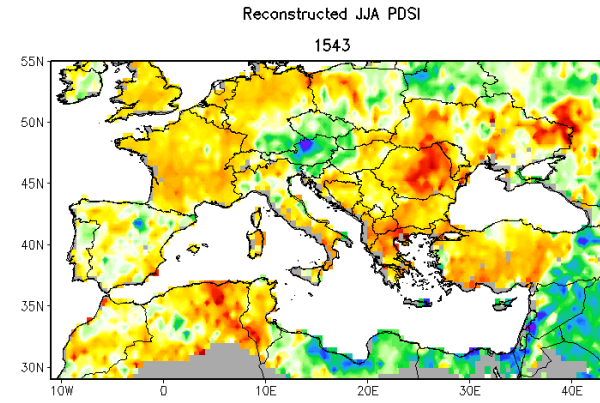
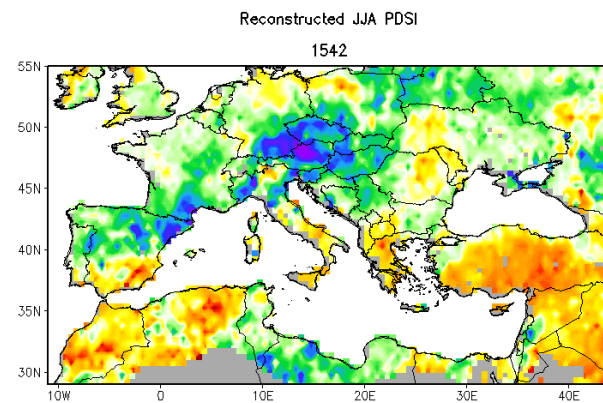
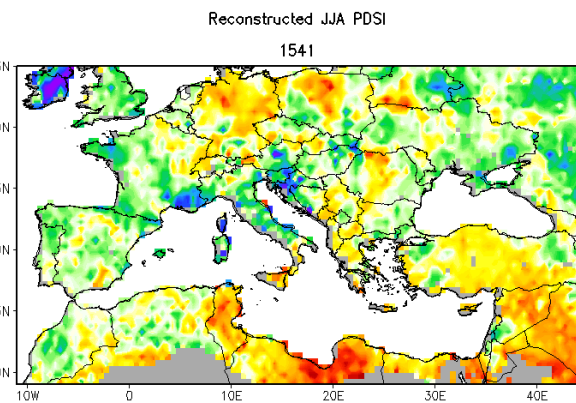
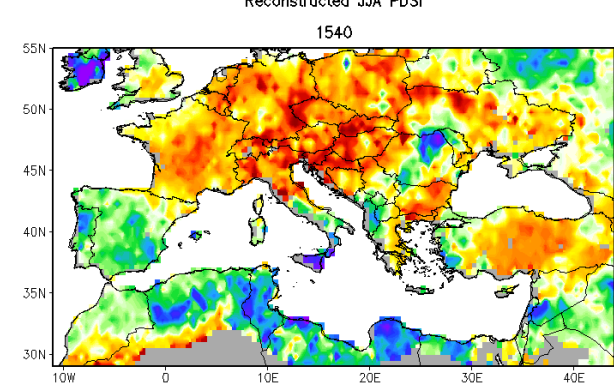
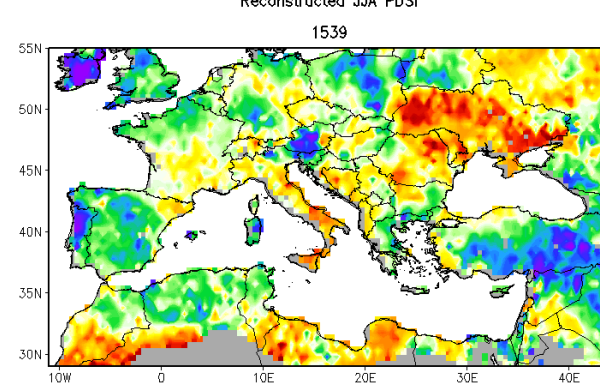
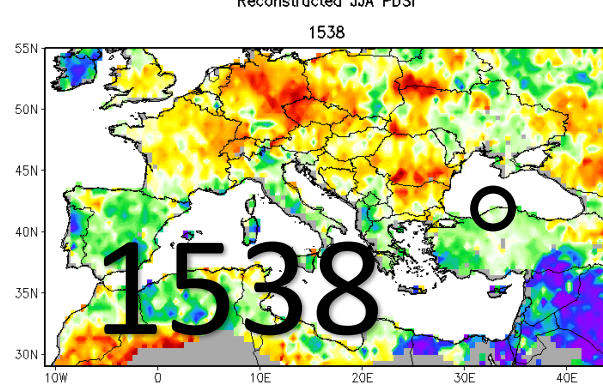
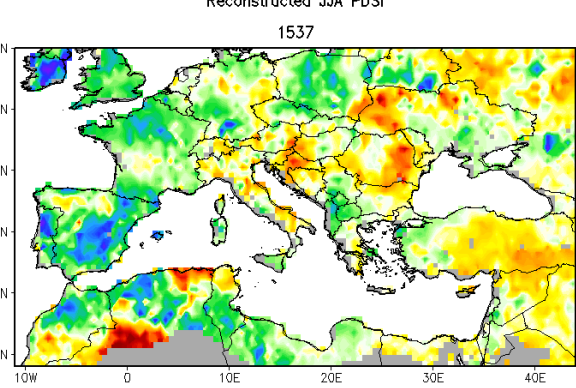
Tax
Organization
Conflict
Disease



Cyprus rice plantations of 1519 faded away
as a result of drier years by 18th century.

Millers went bankrupt
agricultural production declined
Water problems occurred

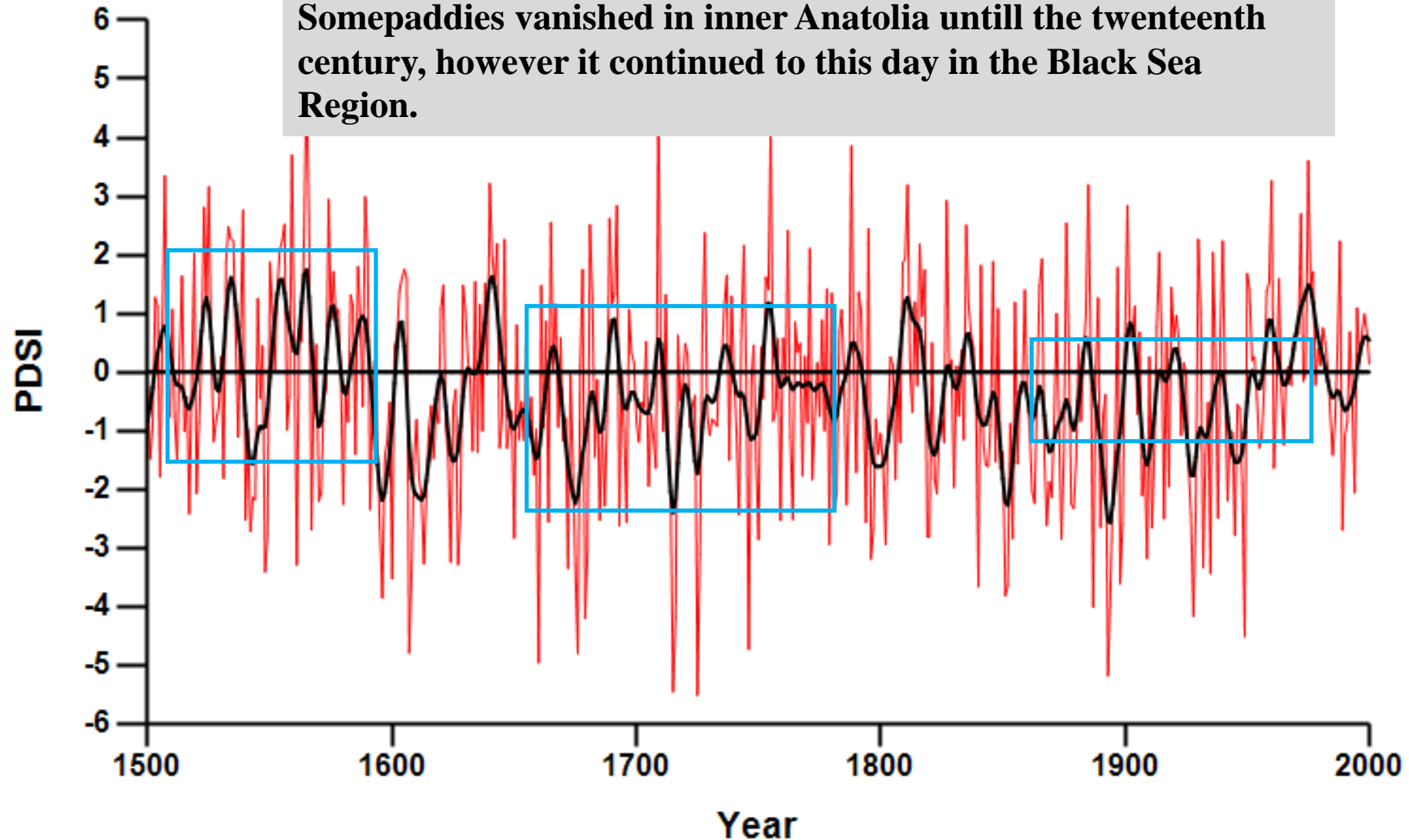




Tax
Organization
Conflict
Disease

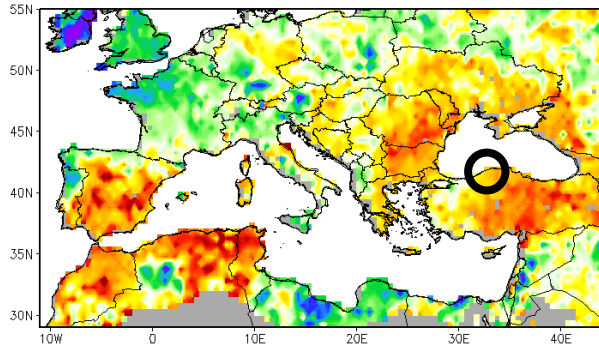
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Mean precipitation values were much higher until late sixteenth century in Inner Anatolia. Decreasing mean precipitation and extreme droughts caused problems in rice production. Some paddies vanished in inner Anatolia until the twentieth century, however it continued to this day in the Black Sea Region.



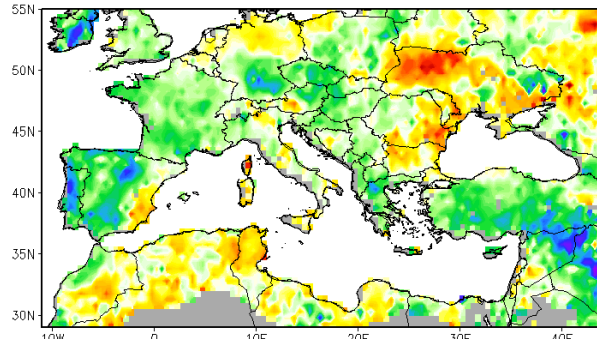
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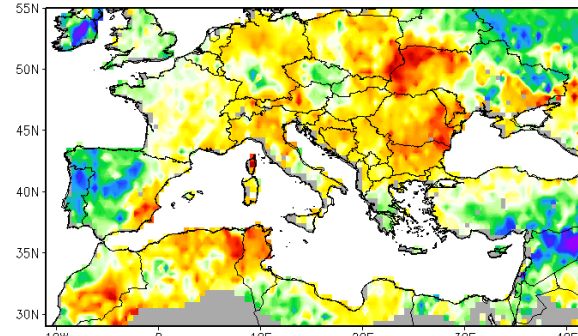
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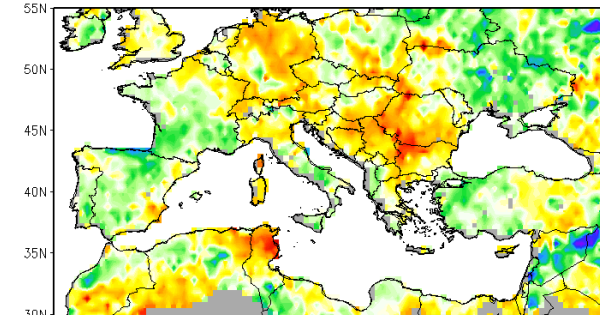
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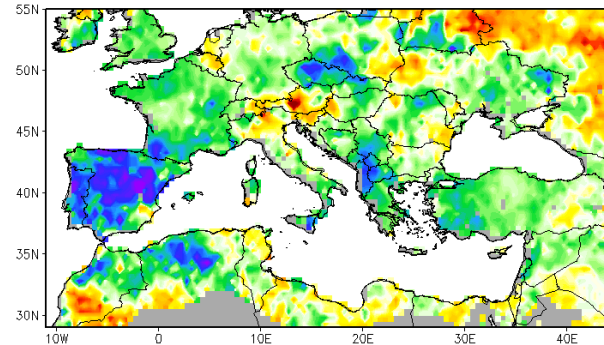
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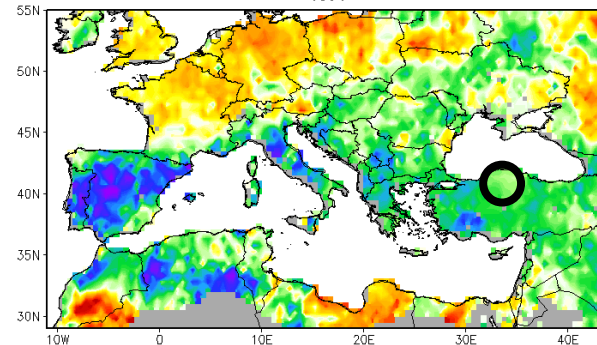
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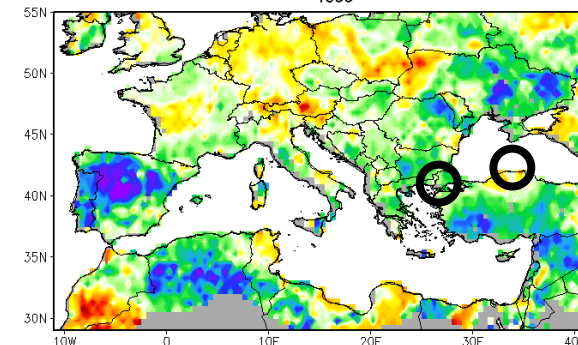
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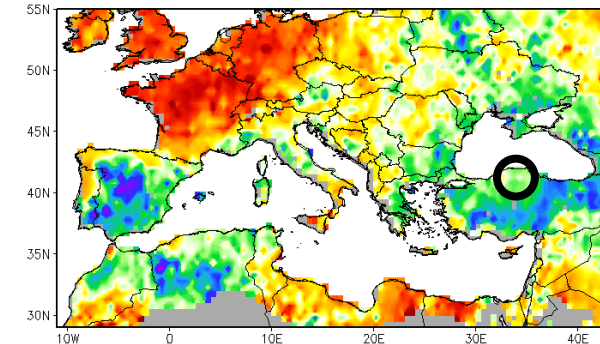
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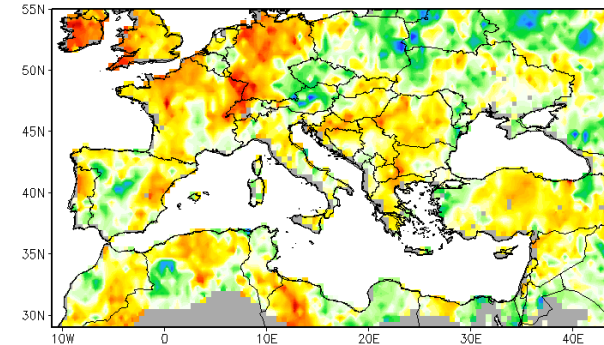
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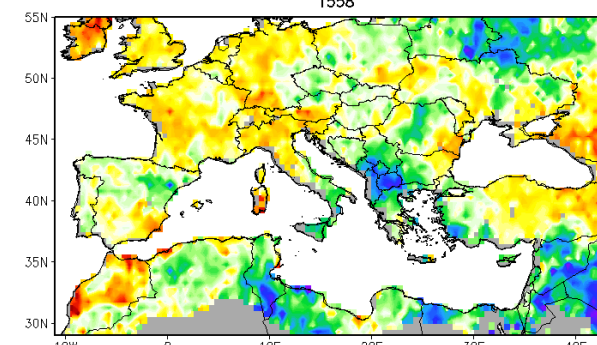
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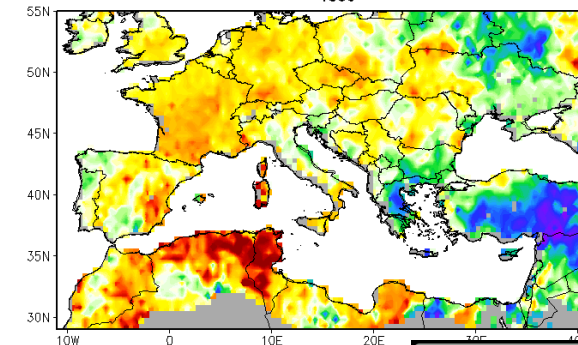
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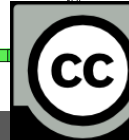
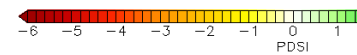
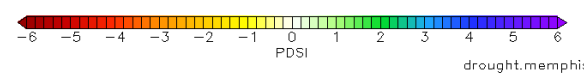
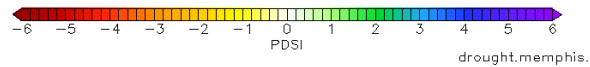
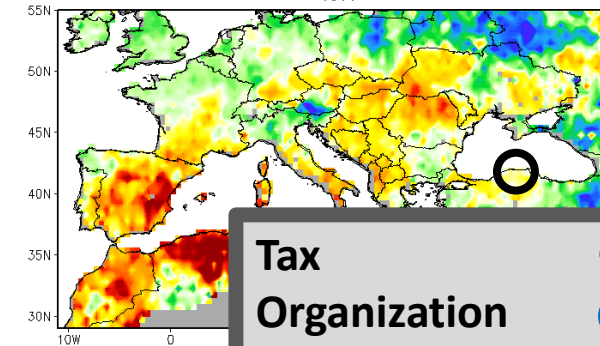
Reconstructed JJA PDSI

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Reconstructed JJA PDSI

1560



Tax
Organization
Conflict
Disease



Temeşvar, known nordest Ottoman rice farm

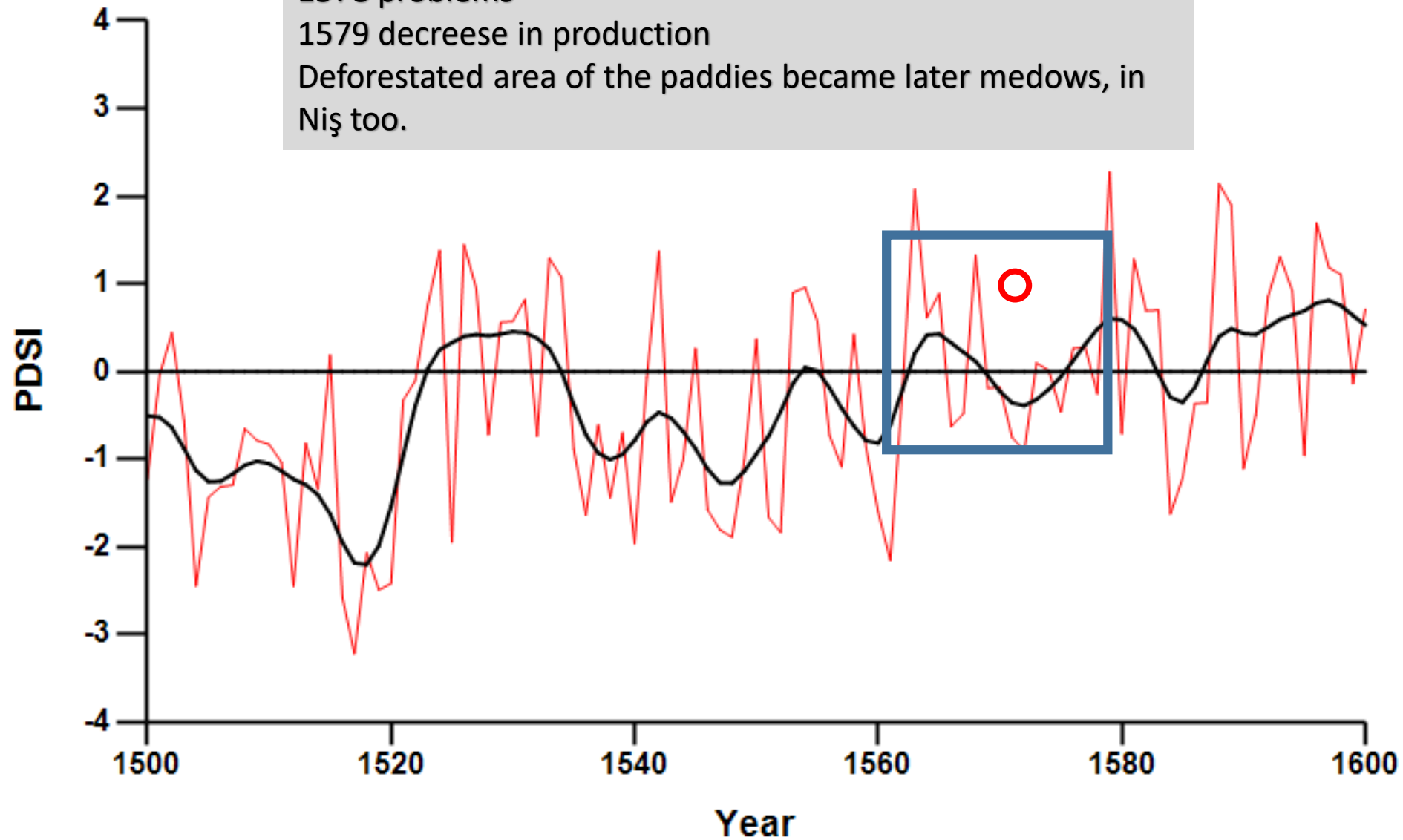
1572 foundation

1573 conflict between the millers & rice producers

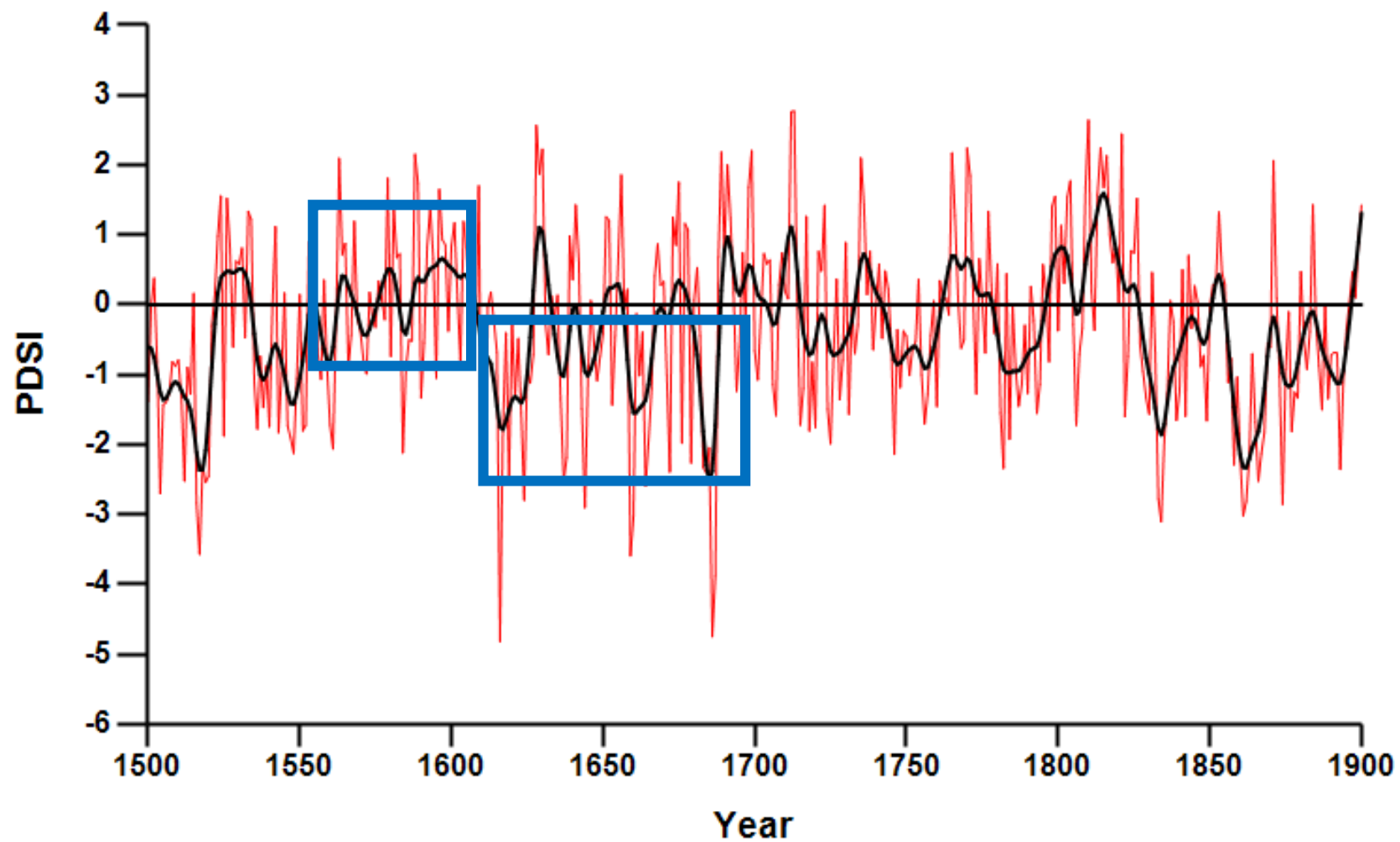
1578 problems

1579 decrease in production

Deforested area of the paddies became later medows, in
Niş too.

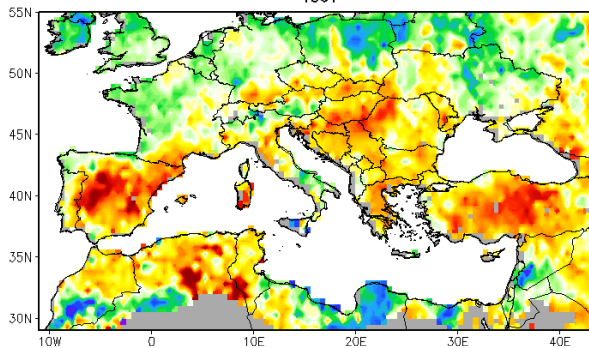


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1500 - 1900, 44.47°N - 49.34°N, 17.89°E - 26.31°E



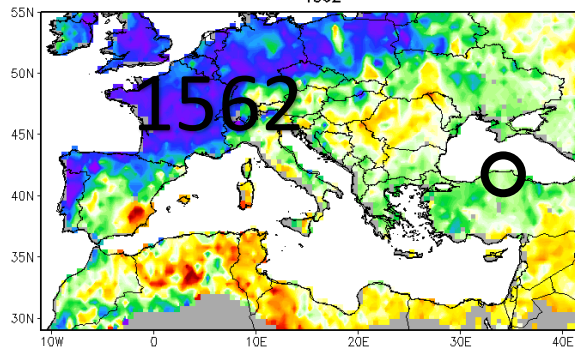
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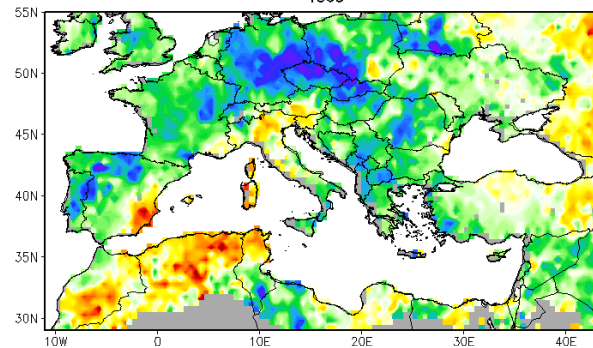
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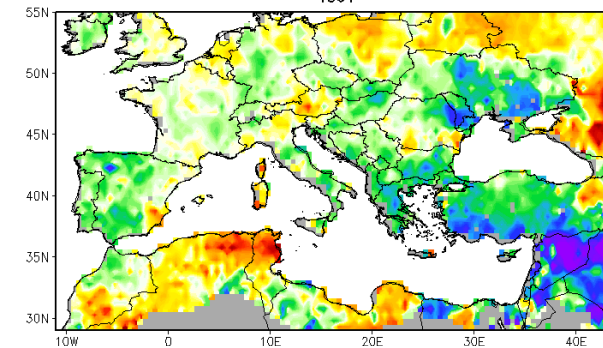
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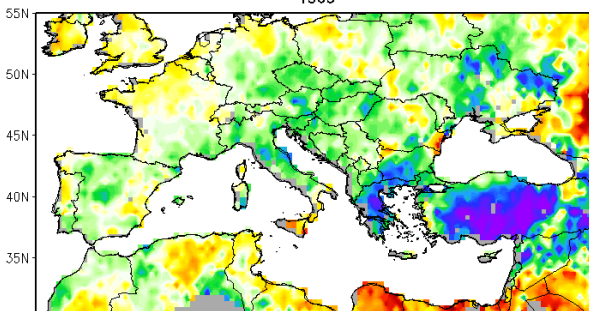
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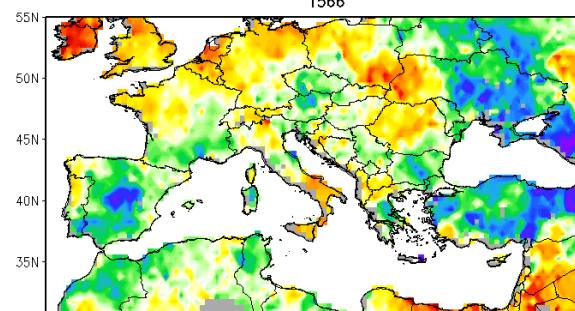
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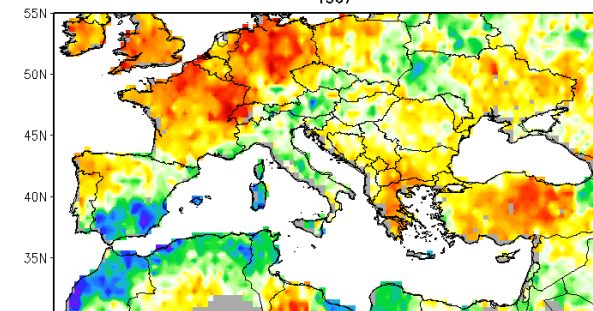
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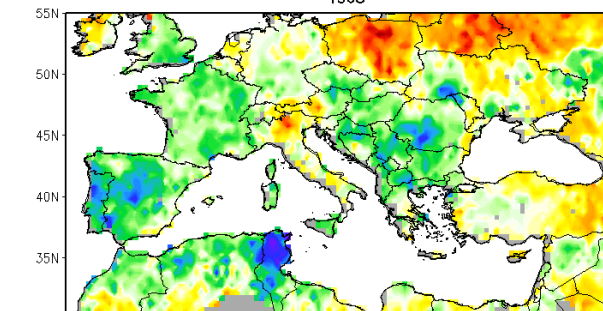
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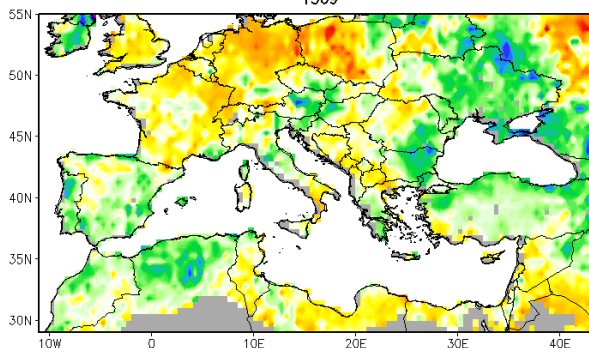
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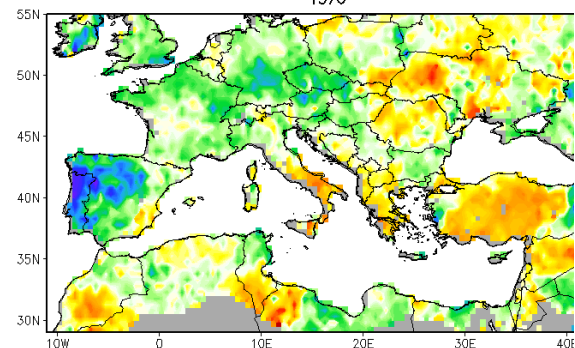
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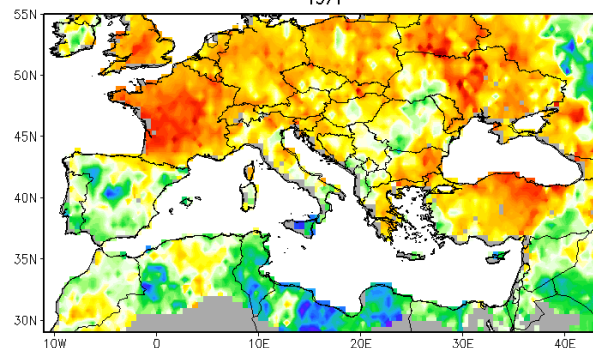
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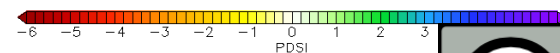
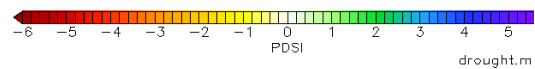
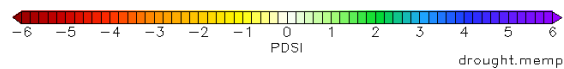
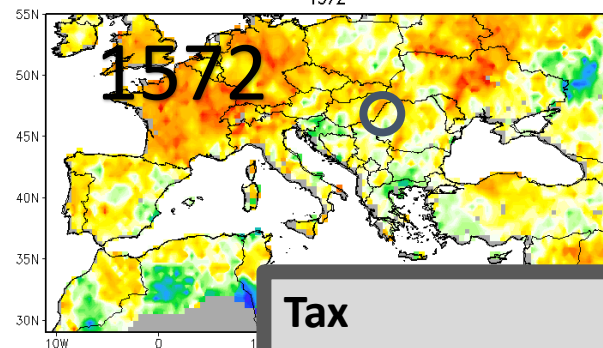
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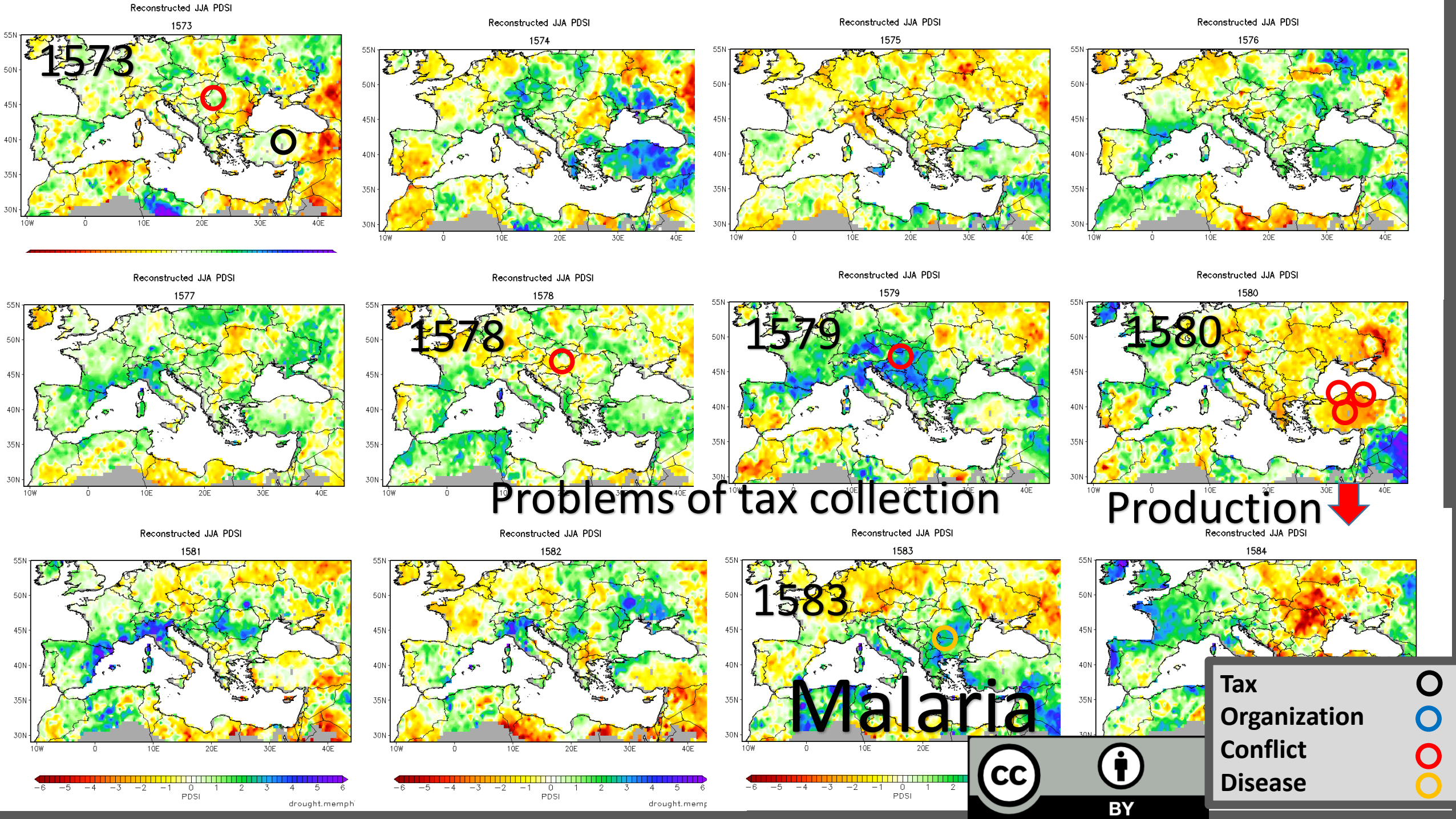
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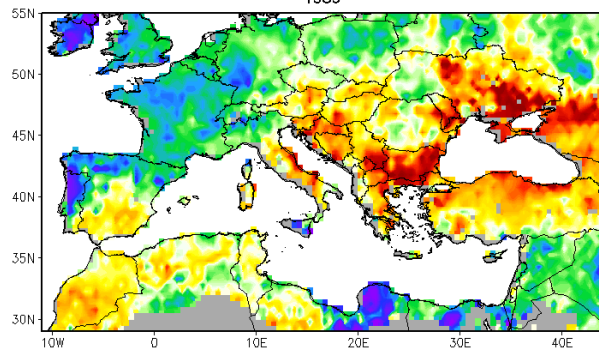
Tax
Organization
Conflict
Disease





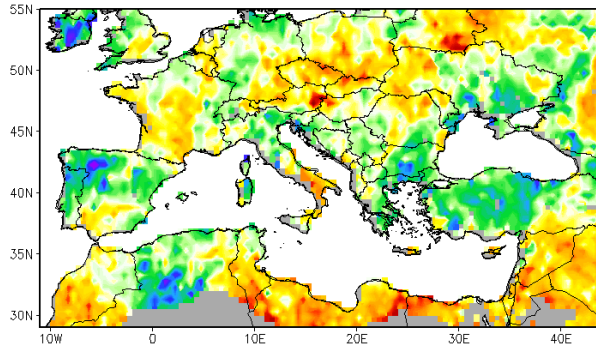
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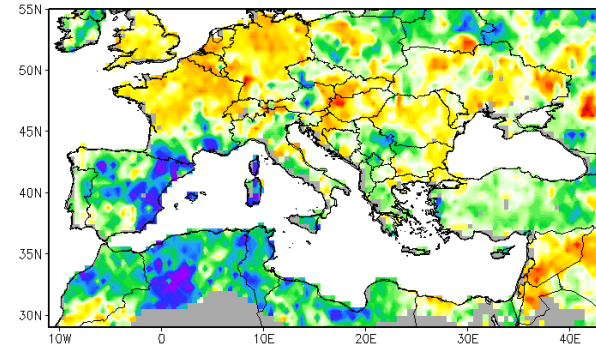
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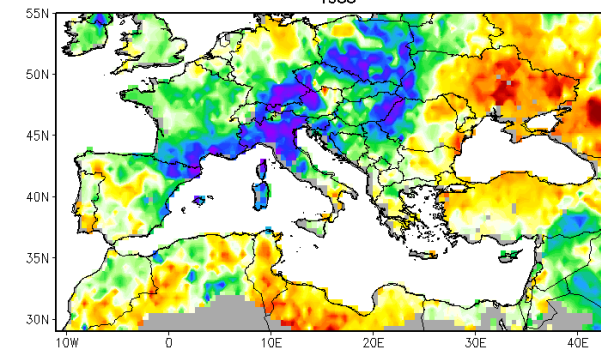
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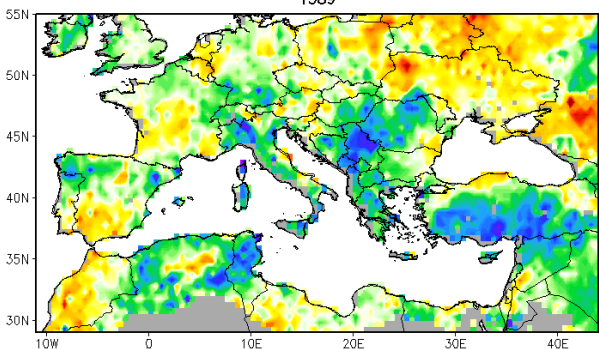
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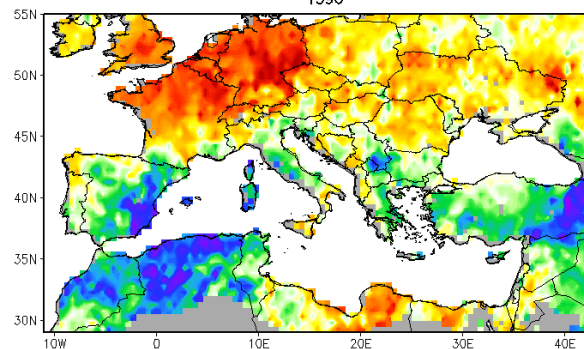
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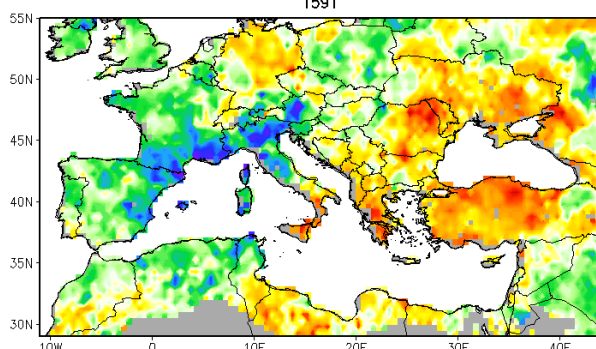
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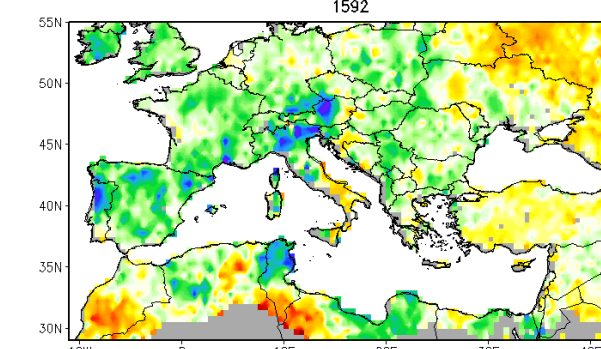
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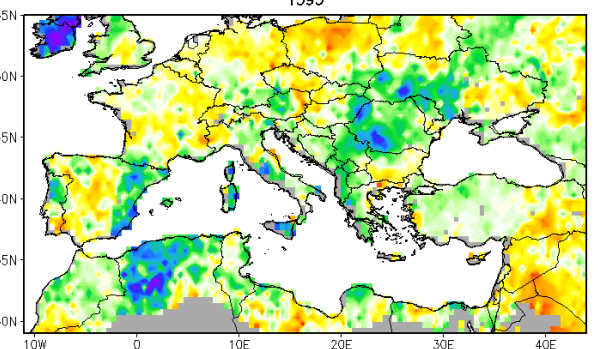
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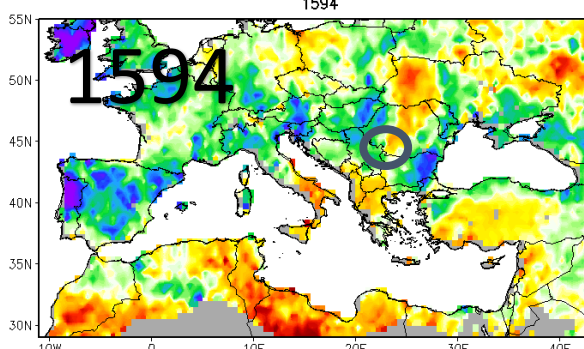
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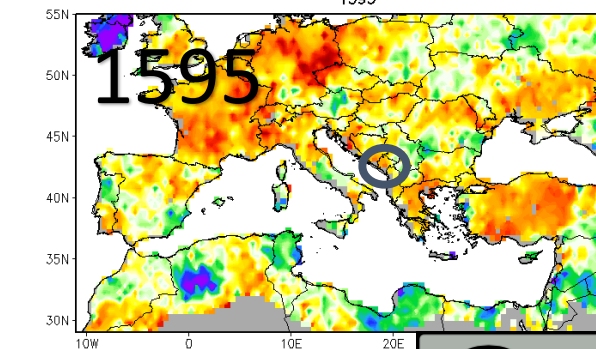
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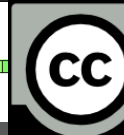
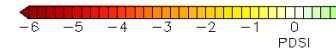
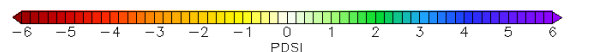
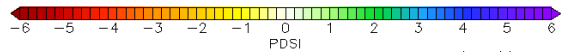
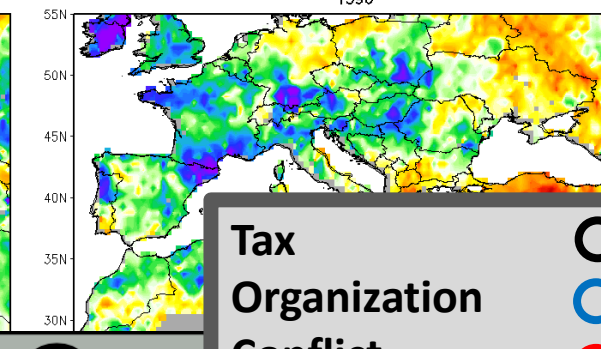
Reconstructed JJA PDSI

1595



Reconstructed JJA PDSI

1596

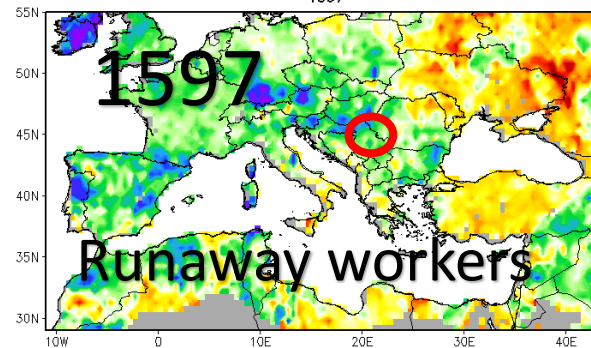


Tax
Organization
Conflict
Disease



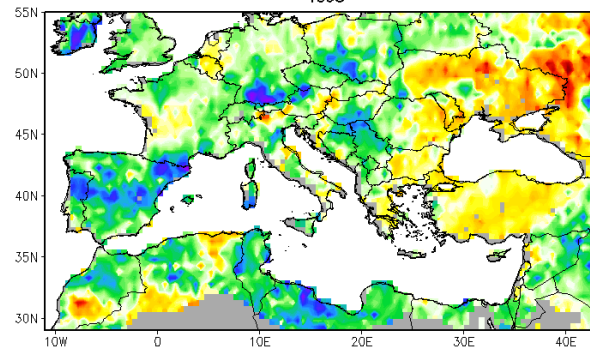
Reconstructed JJA PDSI

1597



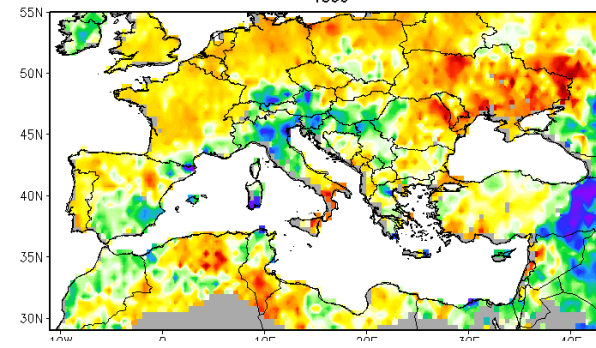
Reconstructed JJA PDSI

1598



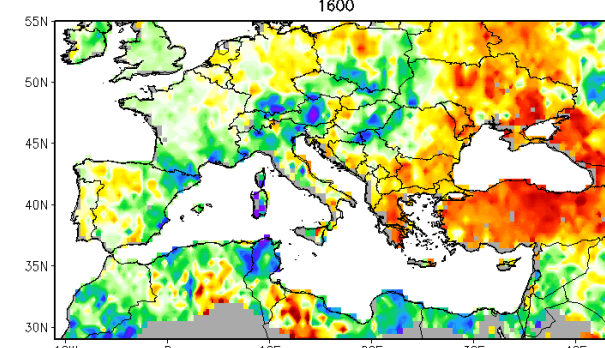
Reconstructed JJA PDSI

1599



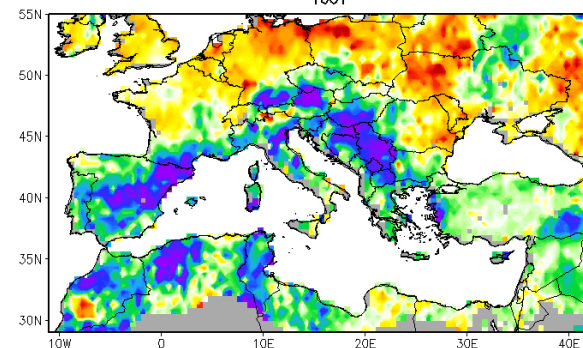
Reconstructed JJA PDSI

1600



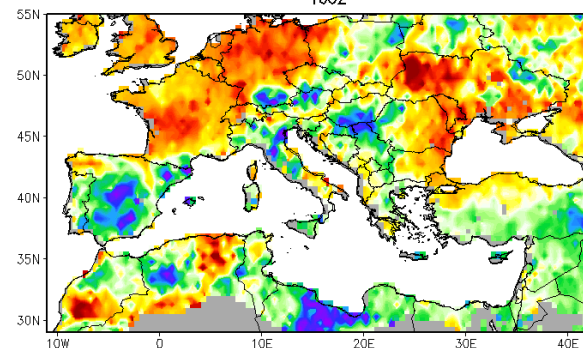
Reconstructed JJA PDSI

1601



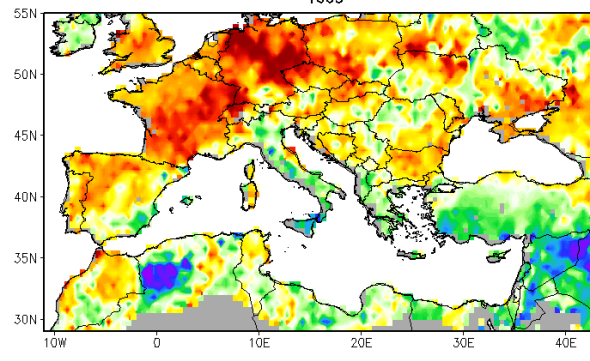
Reconstructed JJA PDSI

1602



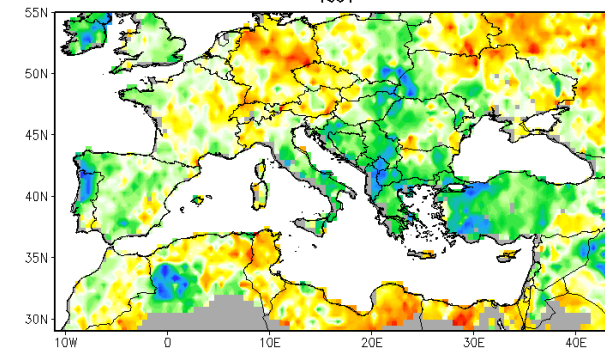
Reconstructed JJA PDSI

1603



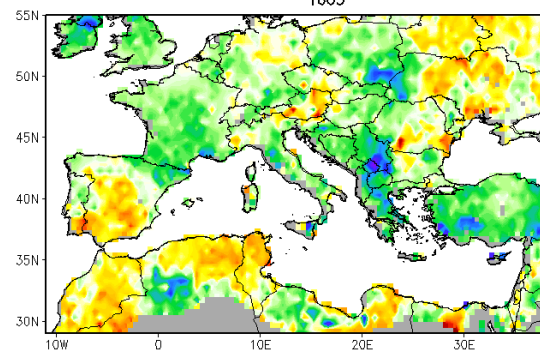
Reconstructed JJA PDSI

1604



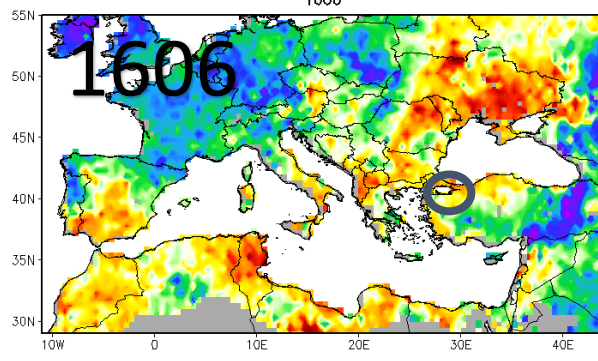
Reconstructed JJA PDSI

1605



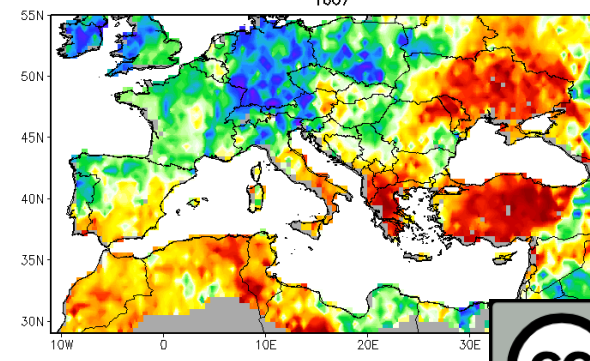
Reconstructed JJA PDSI

1606



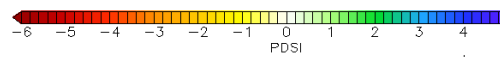
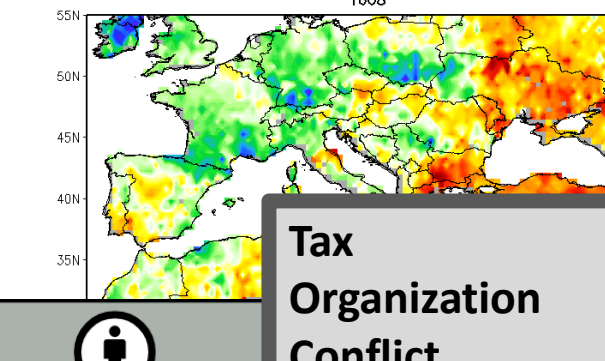
Reconstructed JJA PDSI

1607

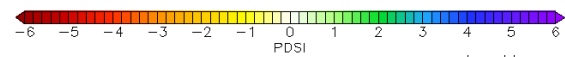


Reconstructed JJA PDSI

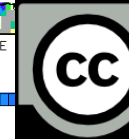
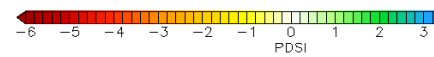
1608



drougl



drought.memphis.e

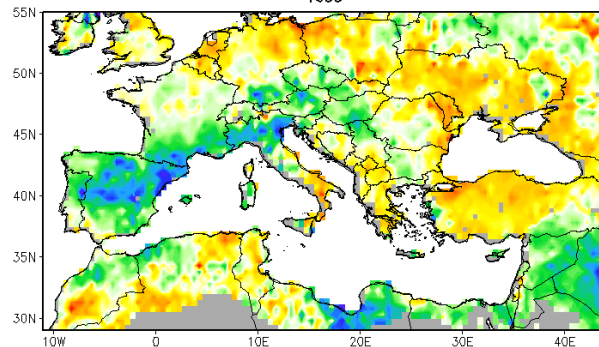


Tax
Organization
Conflict
Disease



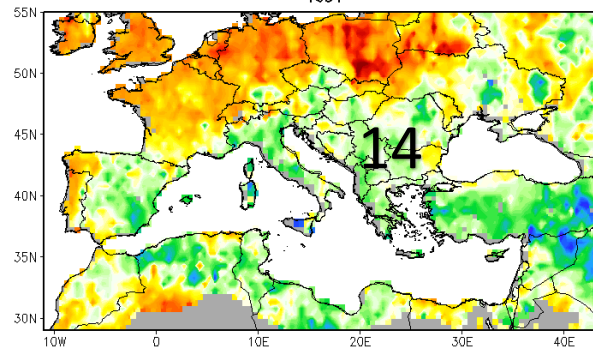
Reconstructed JJA PDSI

1633



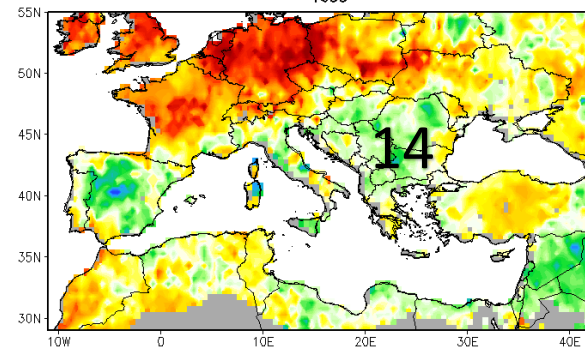
Reconstructed JJA PDSI

1634



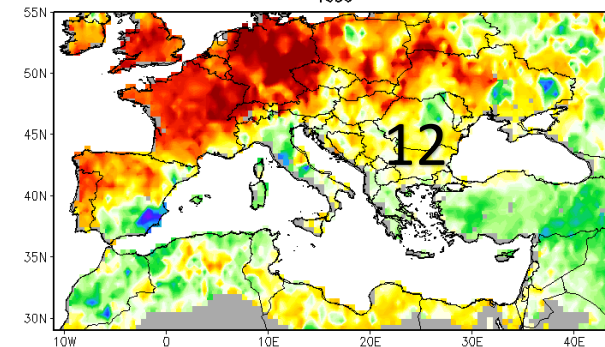
Reconstructed JJA PDSI

1635



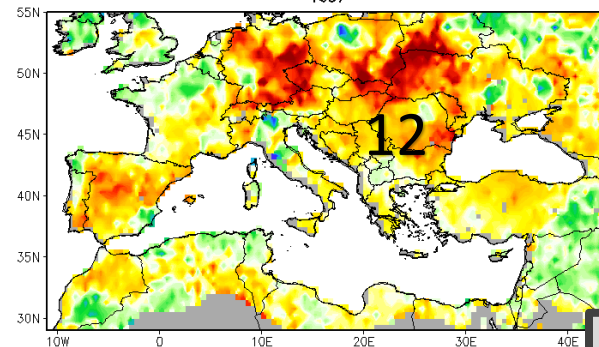
Reconstructed JJA PDSI

1636



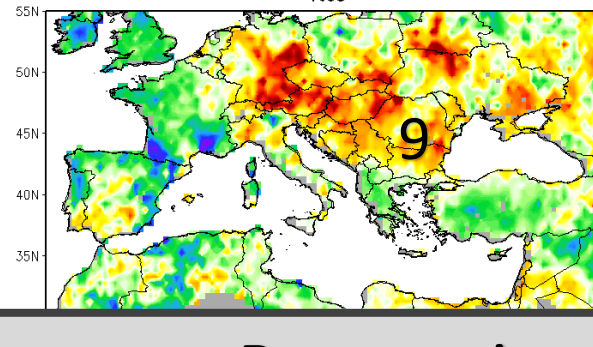
Reconstructed JJA PDSI

1637



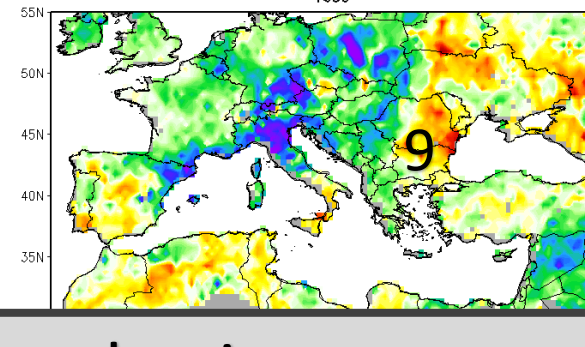
Reconstructed JJA PDSI

1638



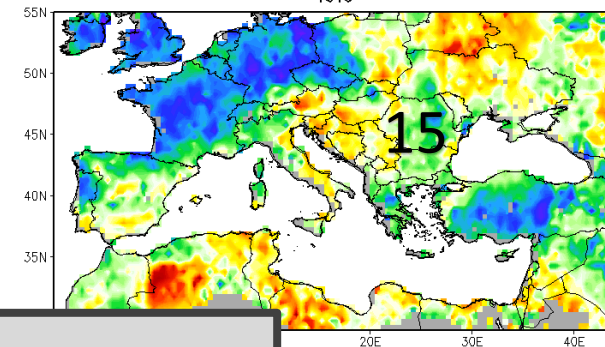
Reconstructed JJA PDSI

1639



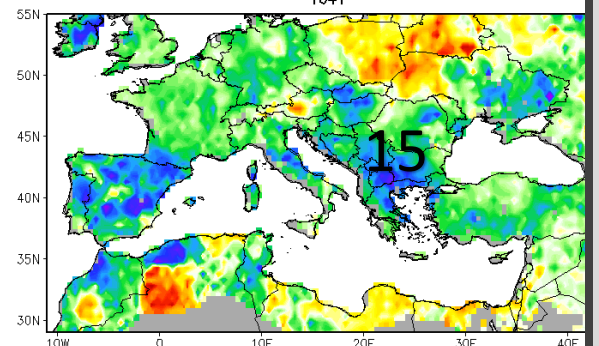
Reconstructed JJA PDSI

1640



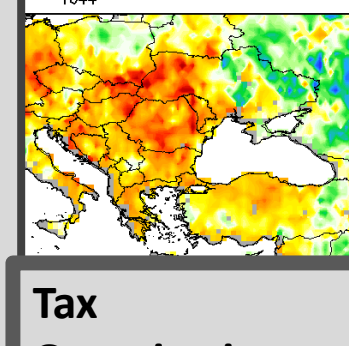
Reconstructed JJA PDSI

1641

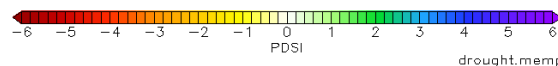


Reconstructed JJA PDSI

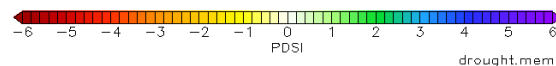
1644



Responsive production amounts
Account Books of Sahabettin Pasa Waqf
in Filibe (Plovdiv, Philipolis) (Oruc, Orbay, 2014).
1Müd= ~32,64 kg

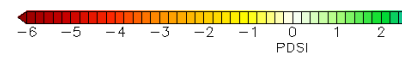


drought.memp



PDSI

drought.memp



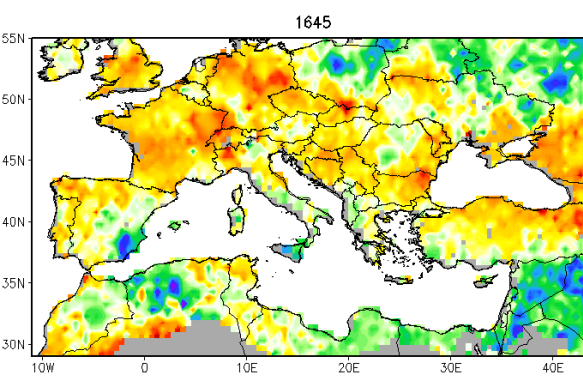
PDSI



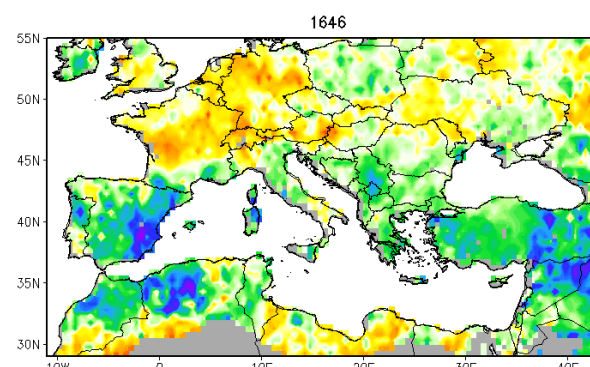
Tax
Organization
Conflict
Disease



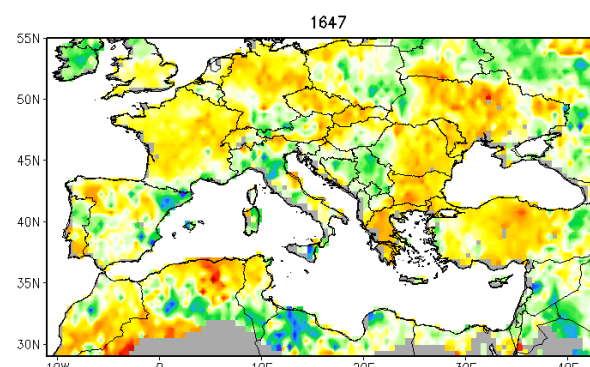
Reconstructed JJA PDSI



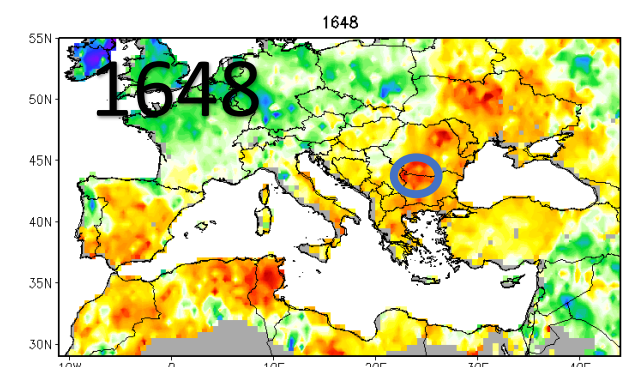
Reconstructed JJA PDSI



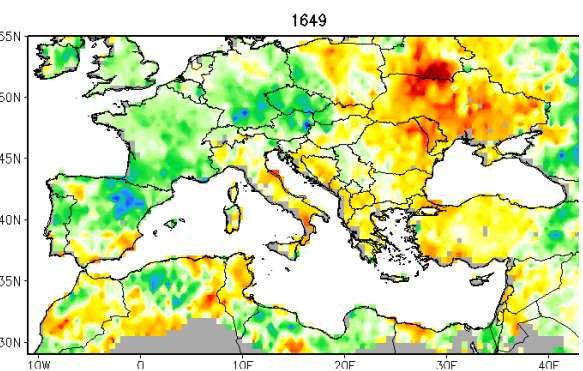
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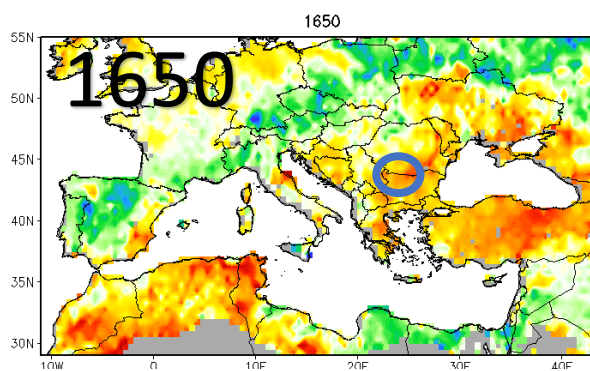
Reconstructed JJA PDSI



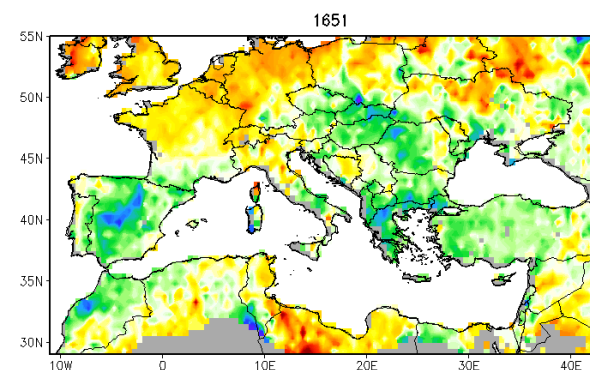
Reconstructed JJA PDSI



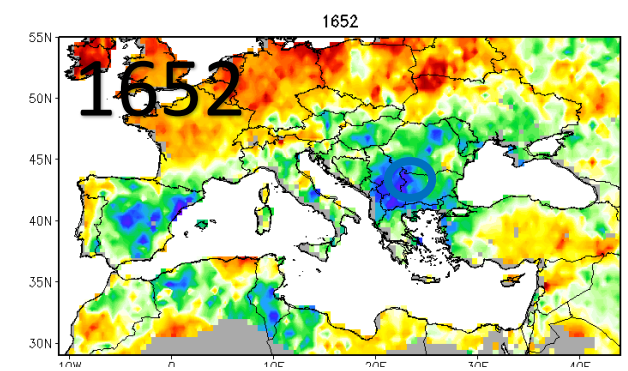
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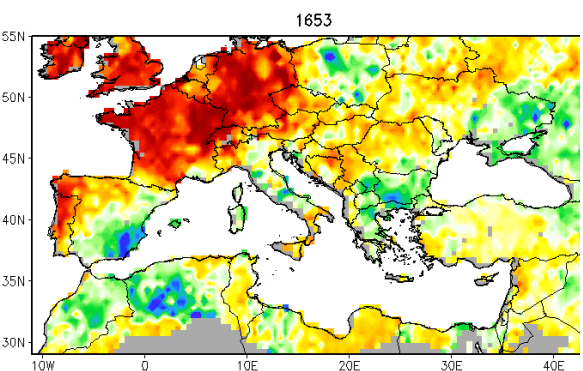
Reconstructed JJA PDSI



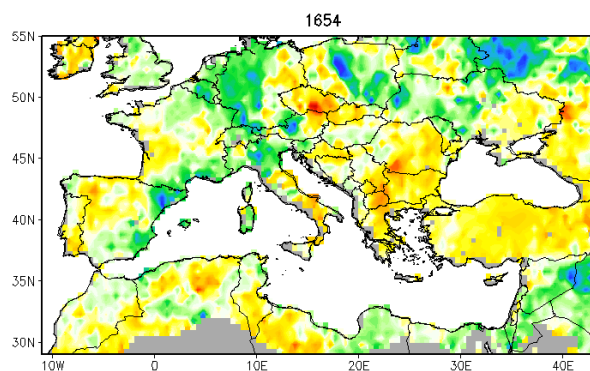
Reconstructed JJA PDSI



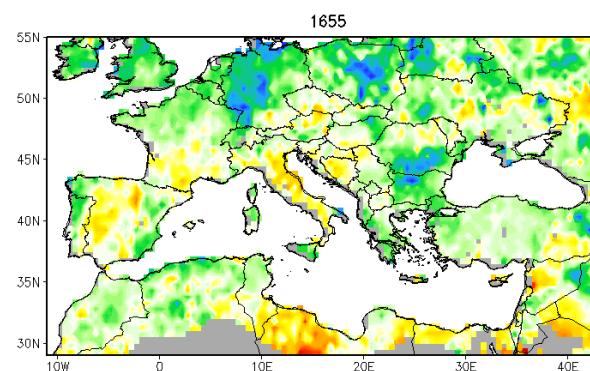
Reconstructed JJA PDSI



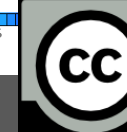
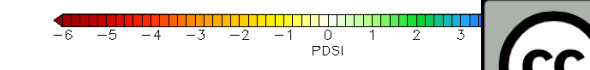
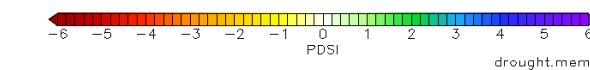
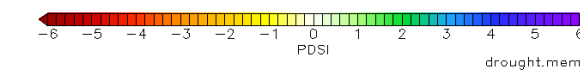
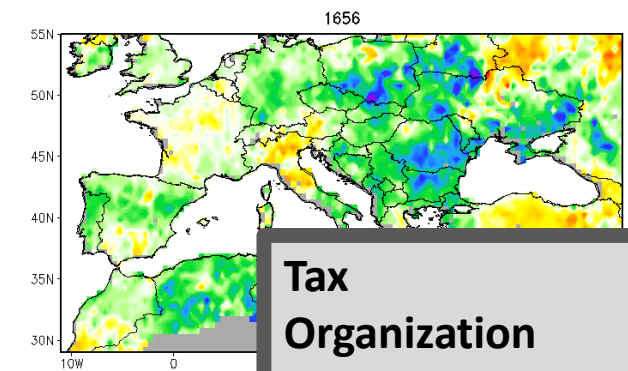
Reconstructed JJA PDSI



Reconstructed JJA PDSI



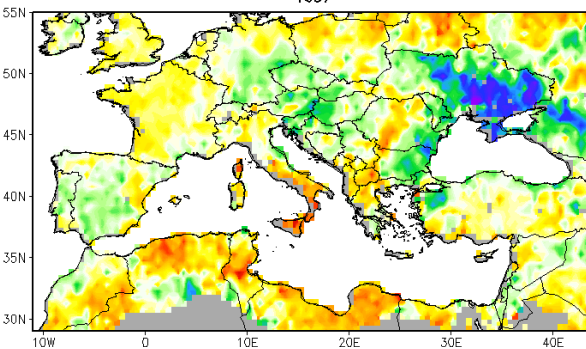
Reconstructed JJA PDSI



Tax
Organization
Conflict
Disease

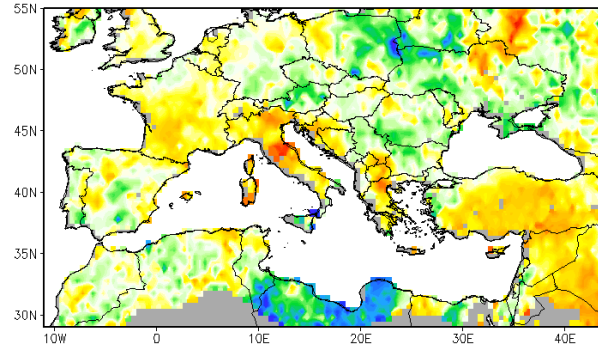
Reconstructed JJA PDSI

1657



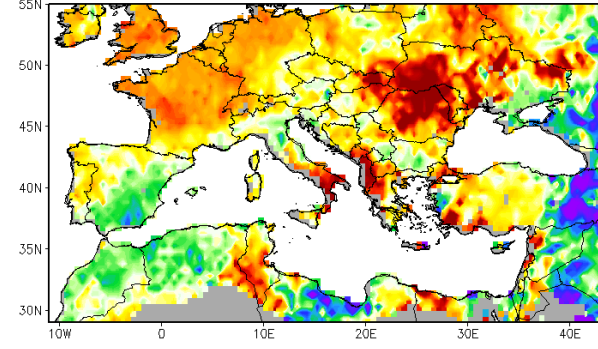
Reconstructed JJA PDSI

1658



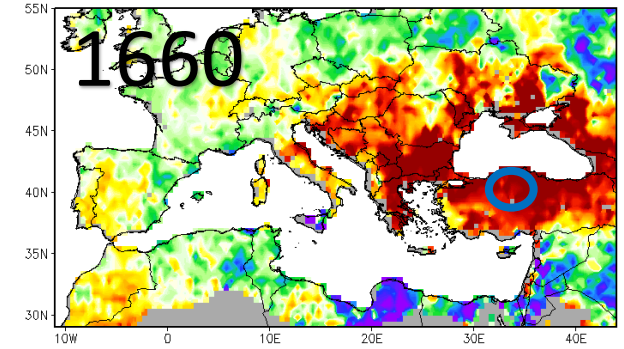
Reconstructed JJA PDSI

1659



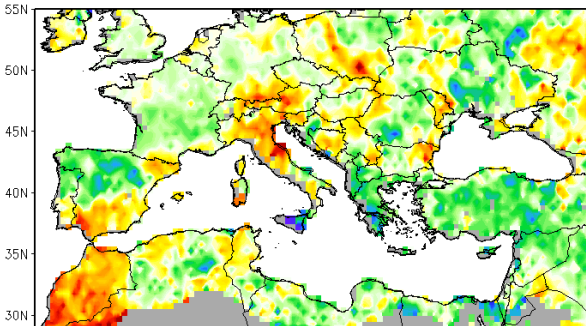
Reconstructed JJA PDSI

1660



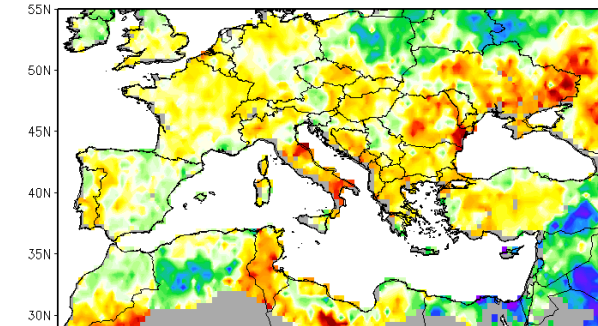
Reconstructed JJA PDSI

1661



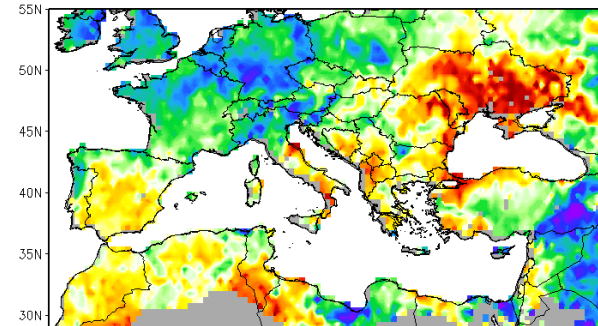
Reconstructed JJA PDSI

1662



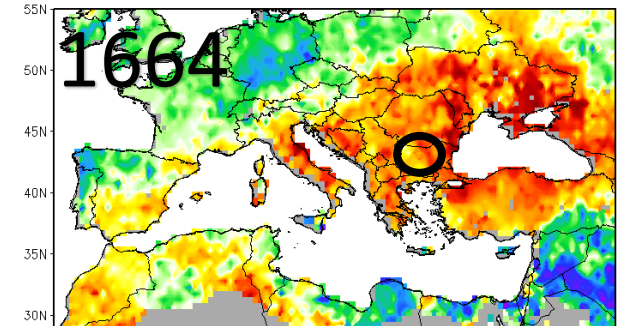
Reconstructed JJA PDSI

1663



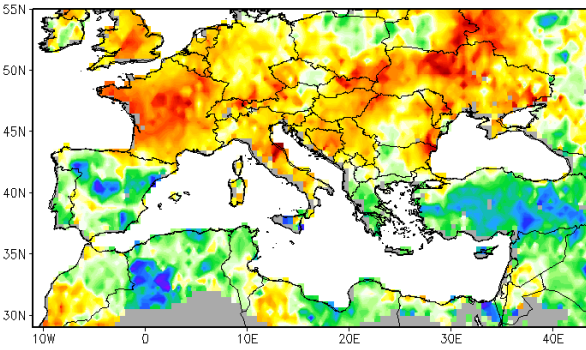
Reconstructed JJA PDSI

1664



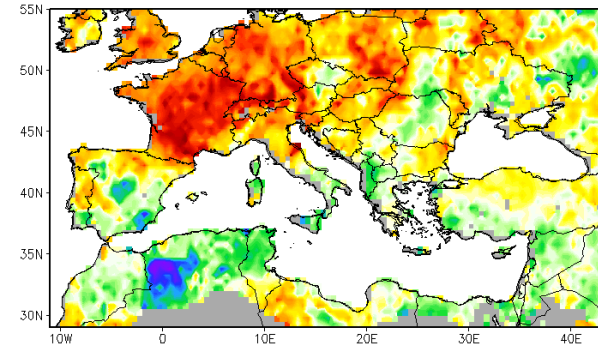
Reconstructed JJA PDSI

1665



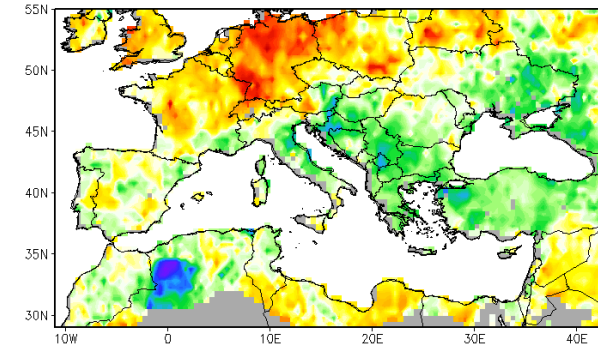
Reconstructed JJA PDSI

1666



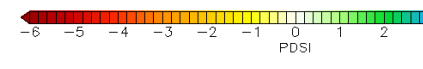
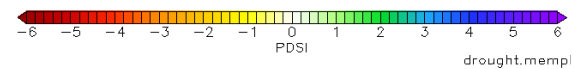
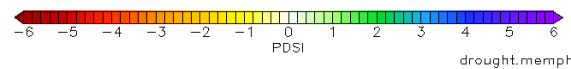
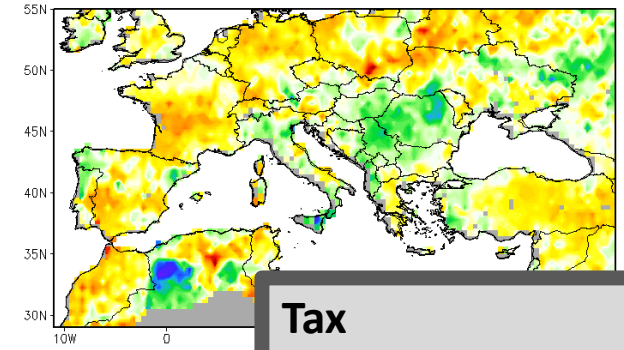
Reconstructed JJA PDSI

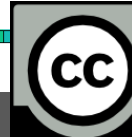
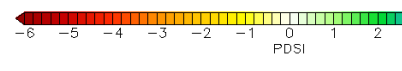
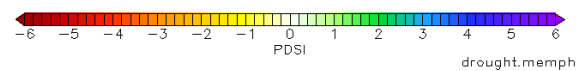
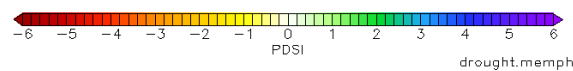
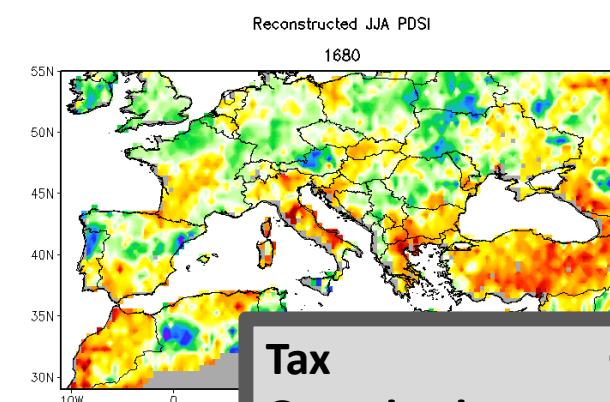
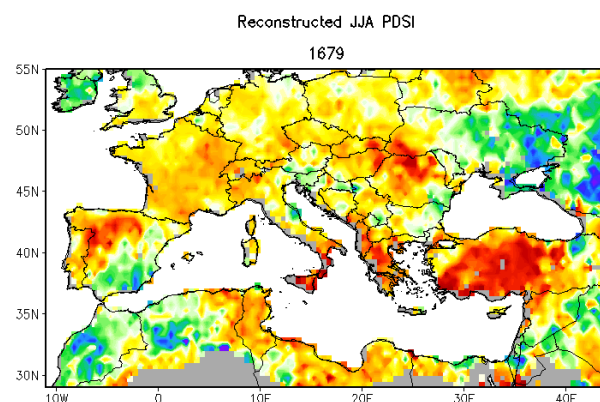
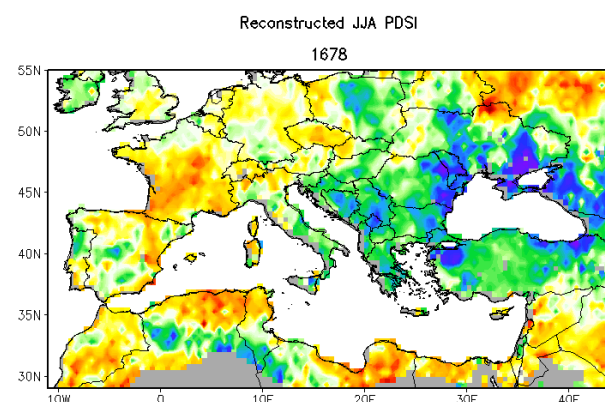
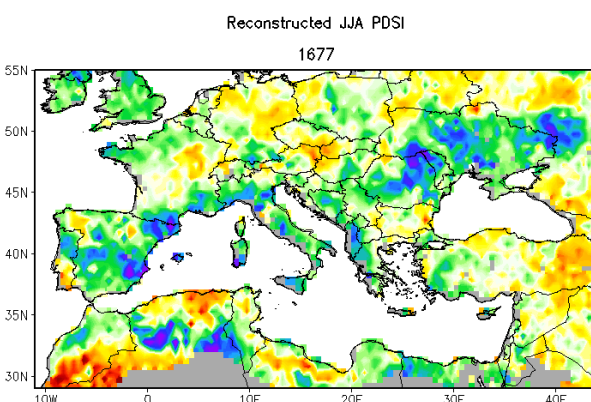
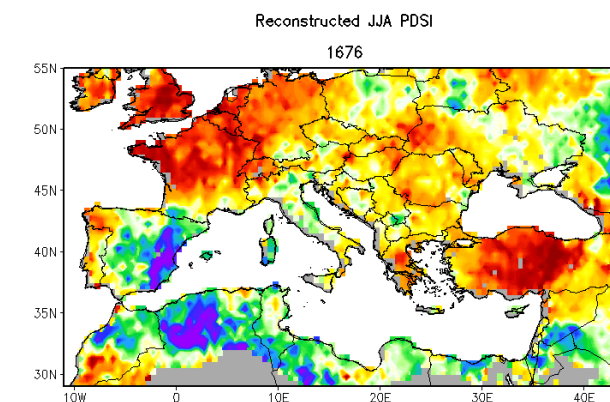
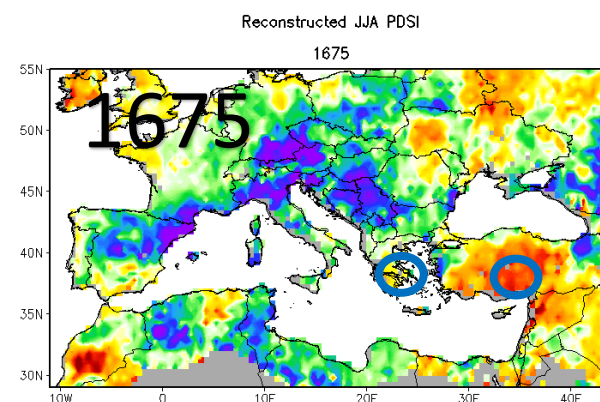
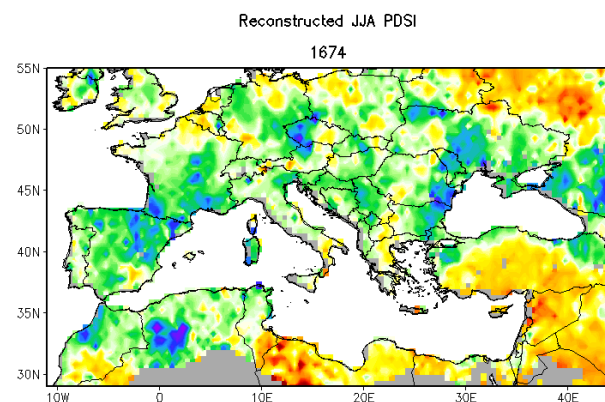
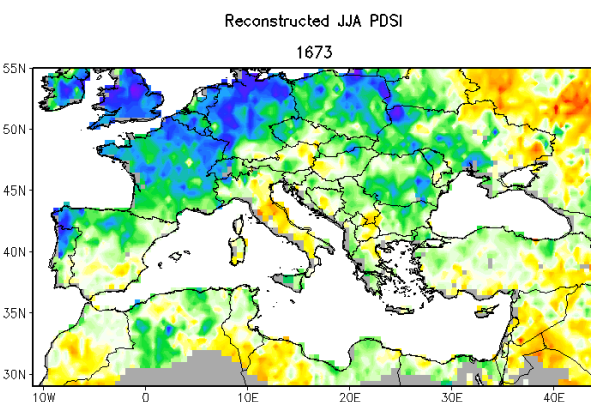
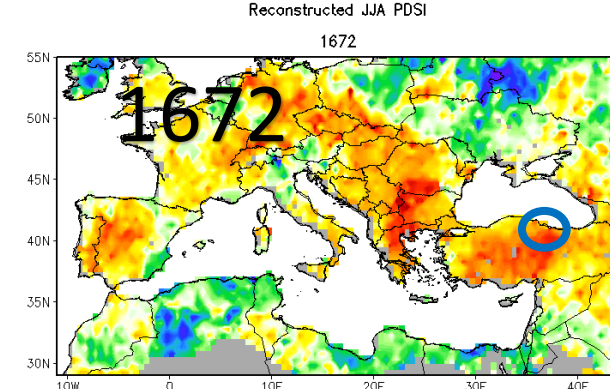
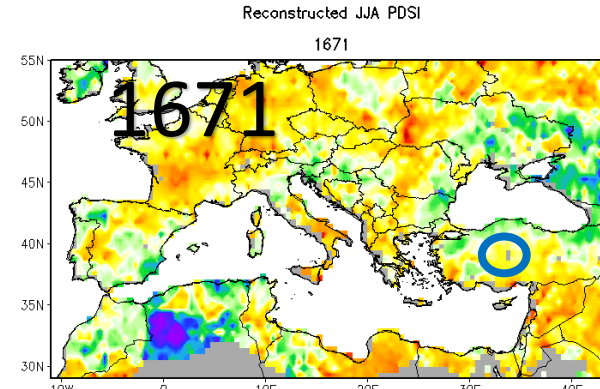
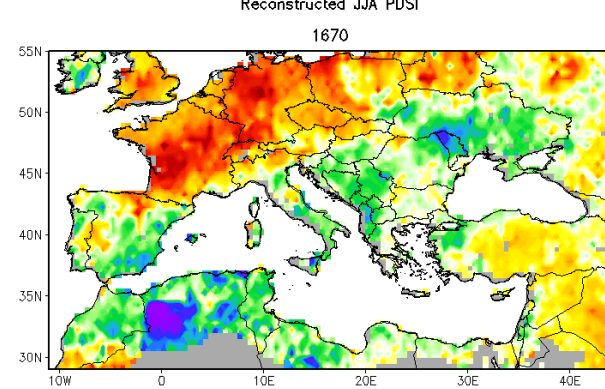
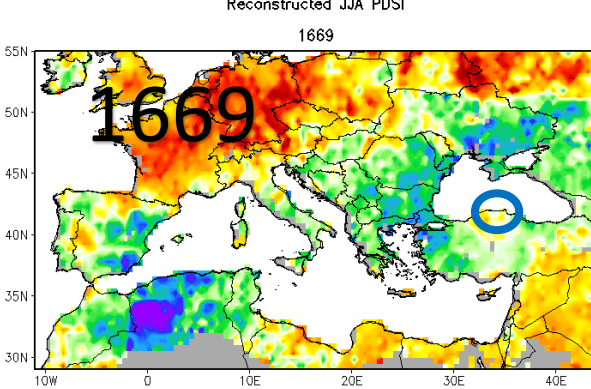
1667



Reconstructed JJA PDSI

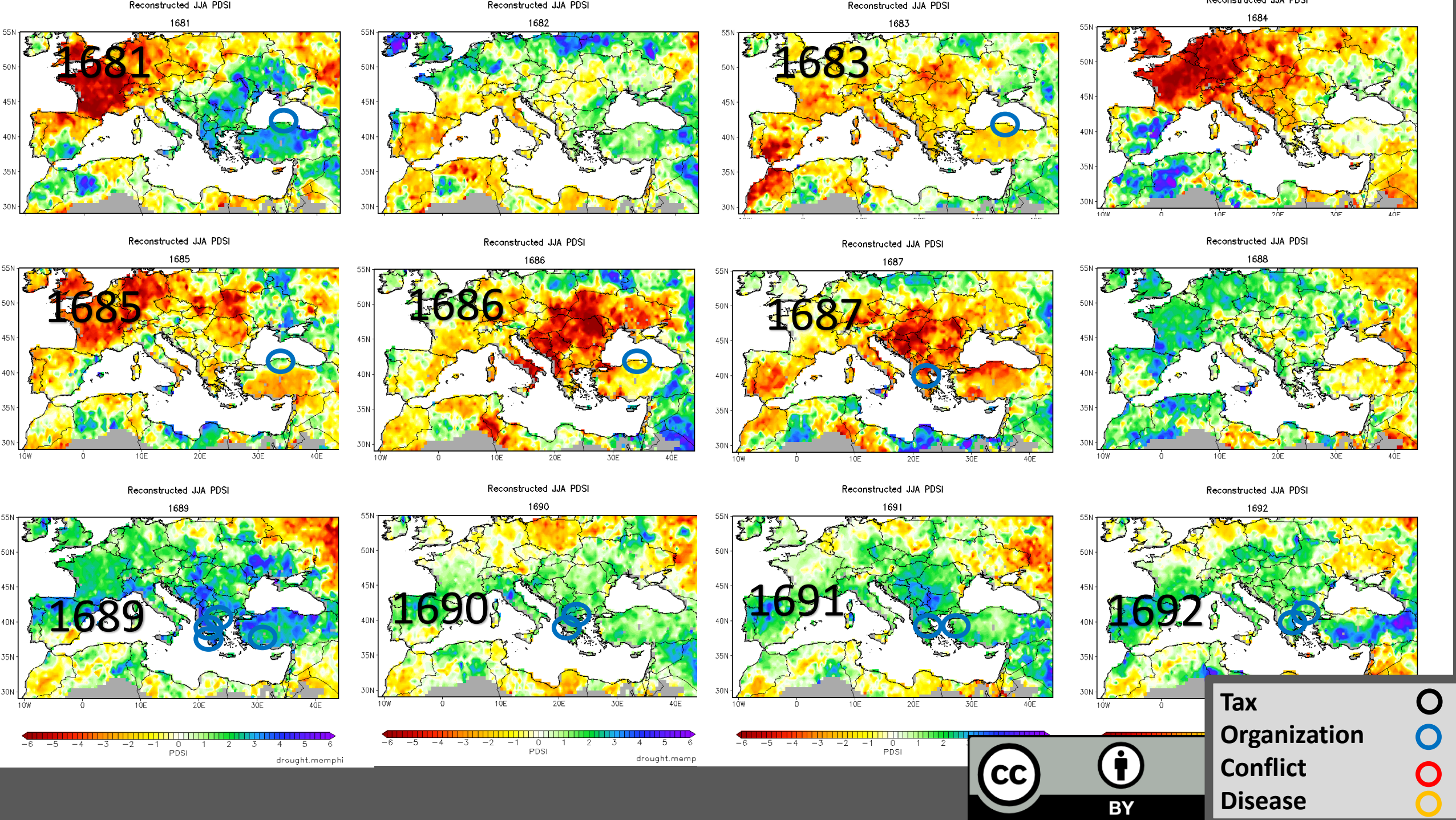
1668





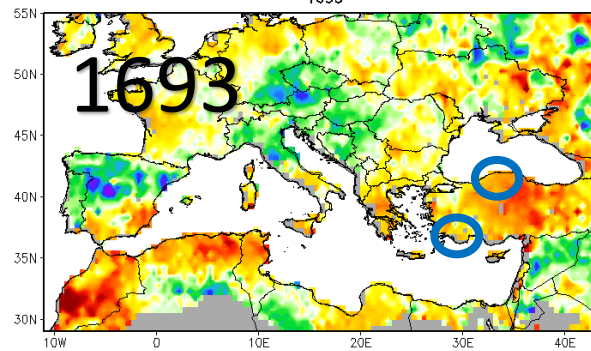
Tax
Organization
Conflict
Disease





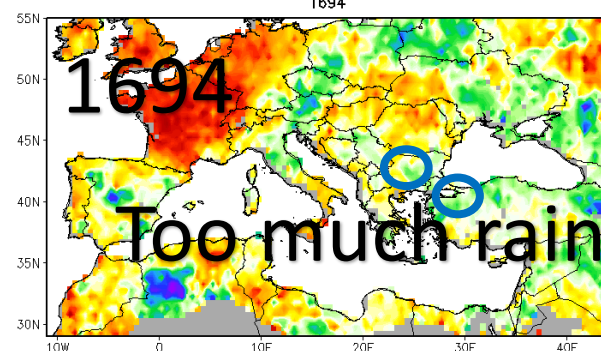
Reconstructed JJA PDSI

1693



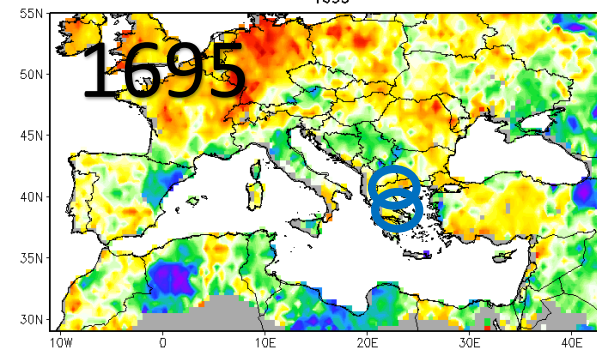
Reconstructed JJA PDSI

1694



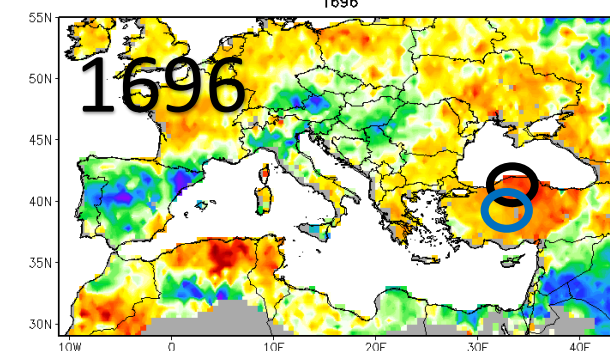
Reconstructed JJA PDSI

1695



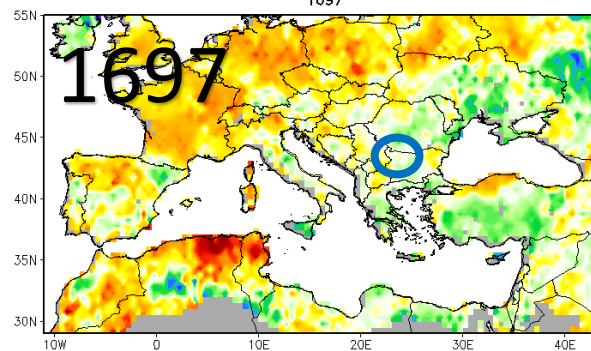
Reconstructed JJA PDSI

1696



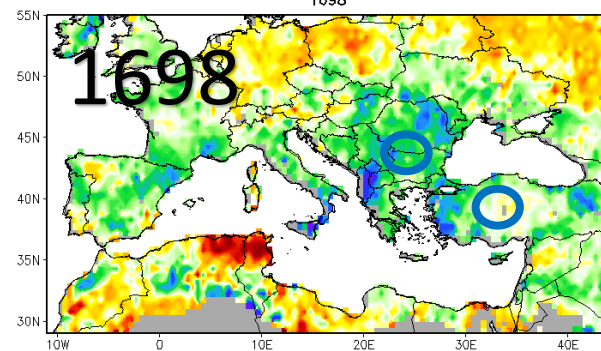
Reconstructed JJA PDSI

1697



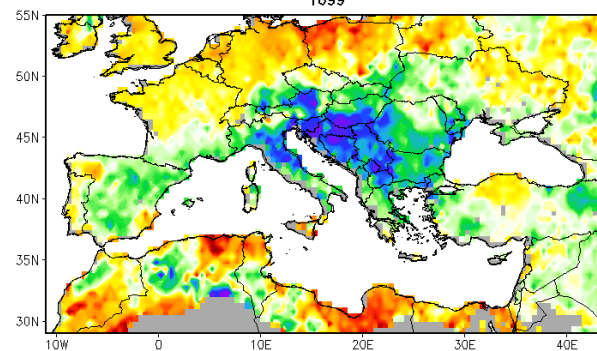
Reconstructed JJA PDSI

1698



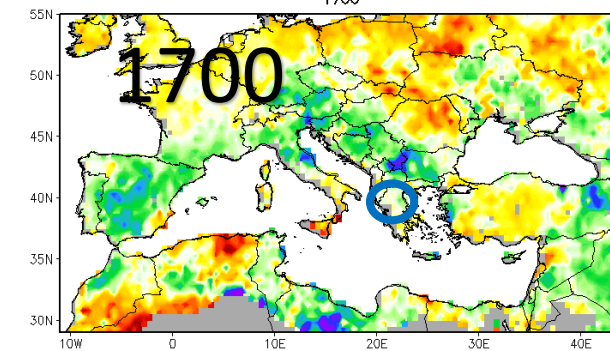
Reconstructed JJA PDSI

1699



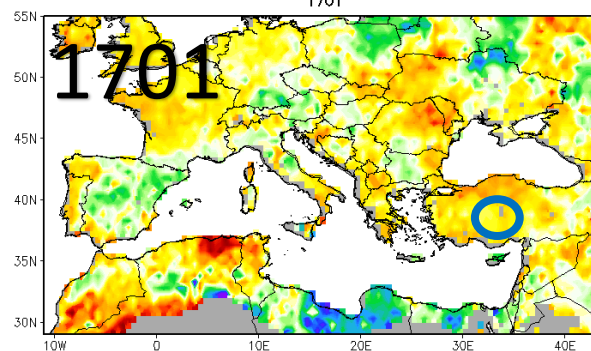
Reconstructed JJA PDSI

1700



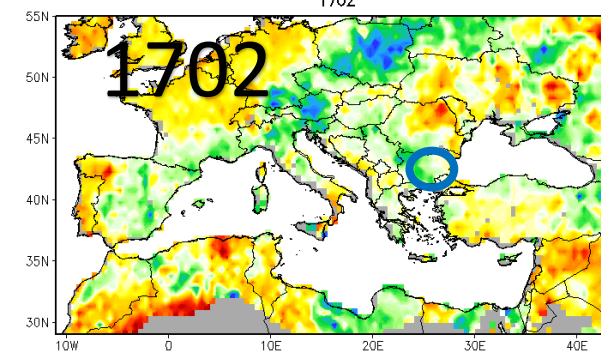
Reconstructed JJA PDSI

1701



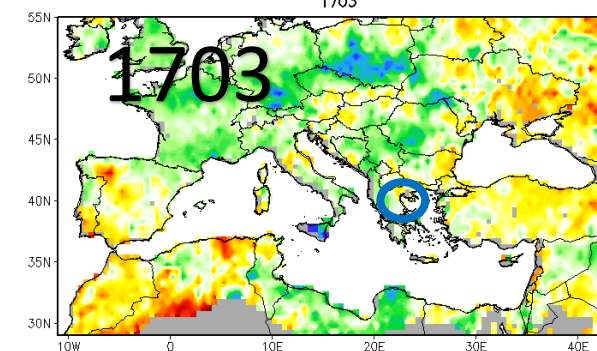
Reconstructed JJA PDSI

1702



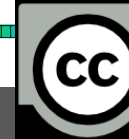
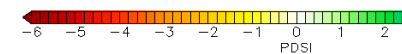
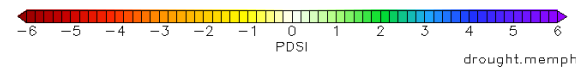
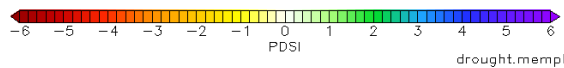
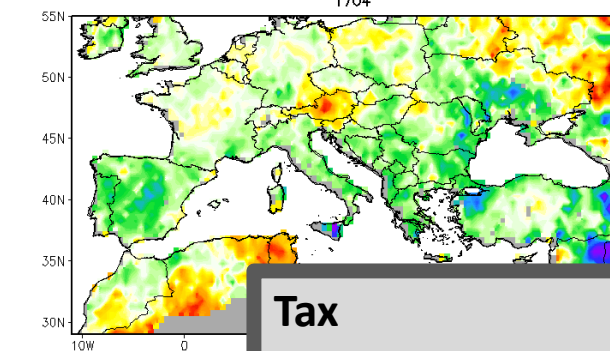
Reconstructed JJA PDSI

1703



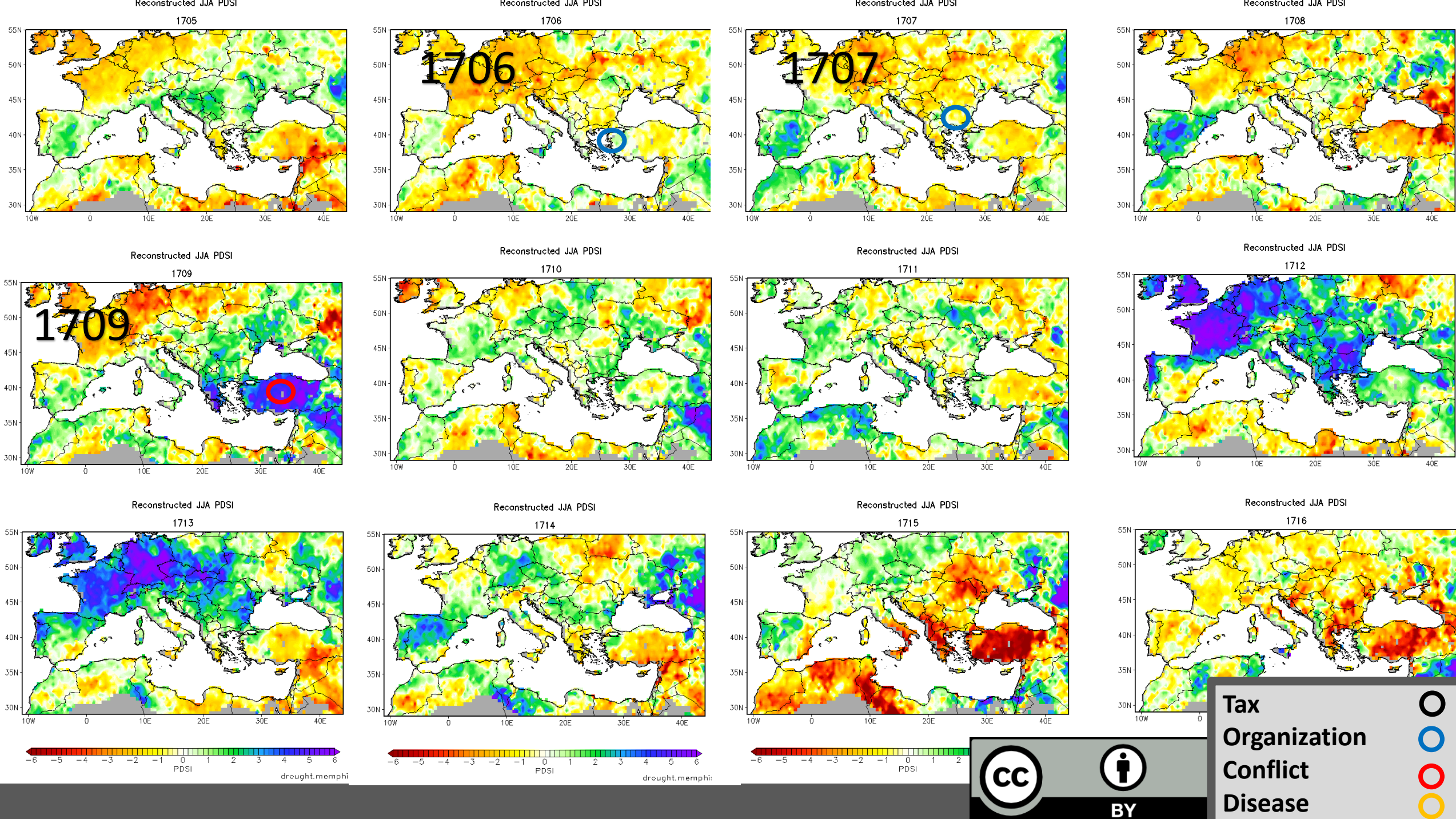
Reconstructed JJA PDSI

1704



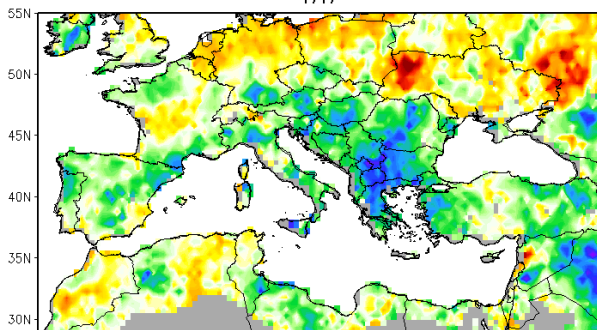
Tax
Organization
Conflict
Disease





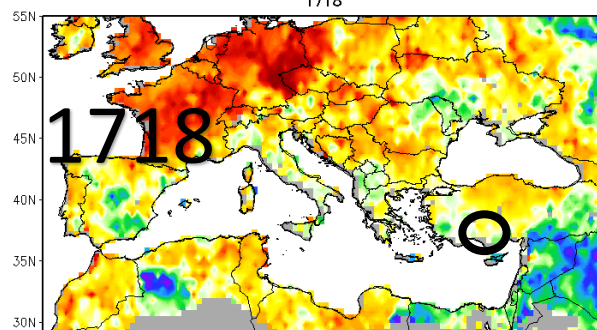
Reconstructed JJA PDSI

1717



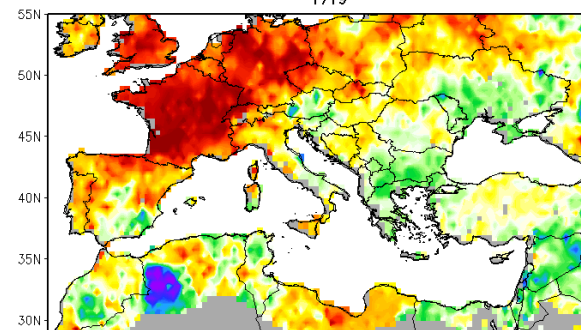
Reconstructed JJA PDSI

1718



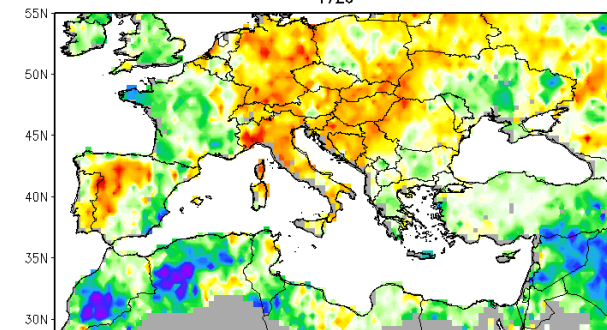
Reconstructed JJA PDSI

1719



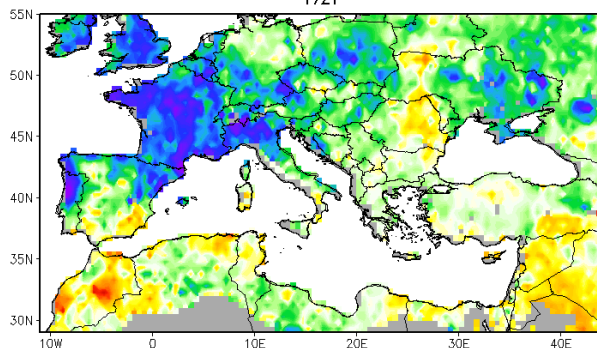
Reconstructed JJA PDSI

1720



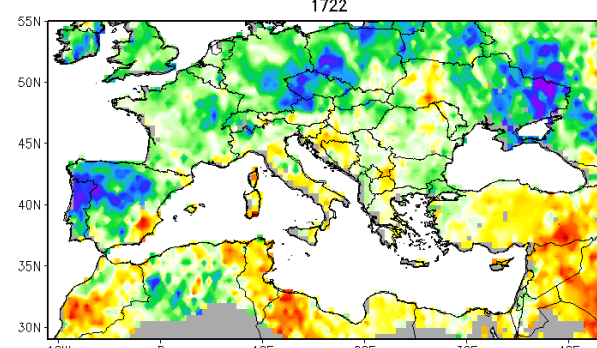
Reconstructed JJA PDSI

1721



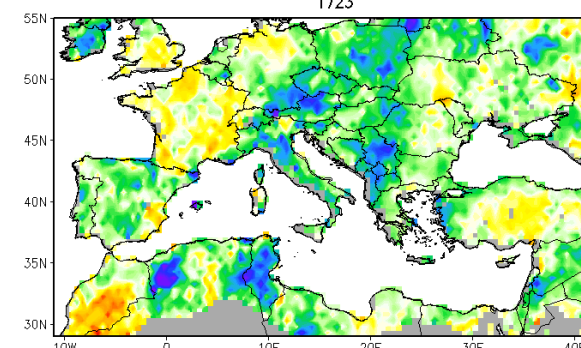
Reconstructed JJA PDSI

1722



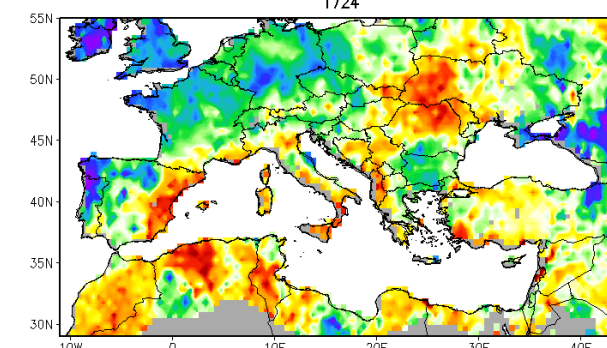
Reconstructed JJA PDSI

1723



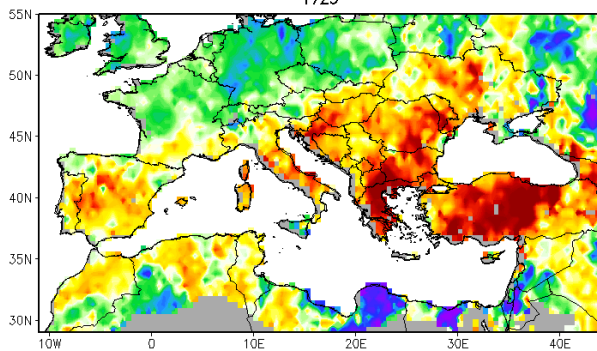
Reconstructed JJA PDSI

1724



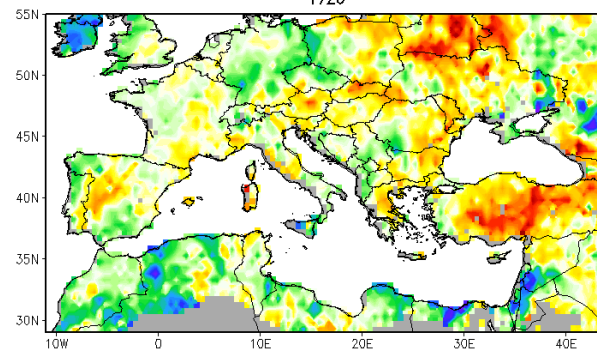
Reconstructed JJA PDSI

1725



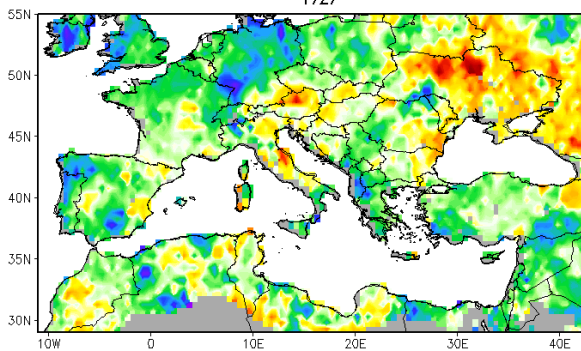
Reconstructed JJA PDSI

1726



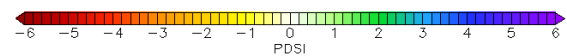
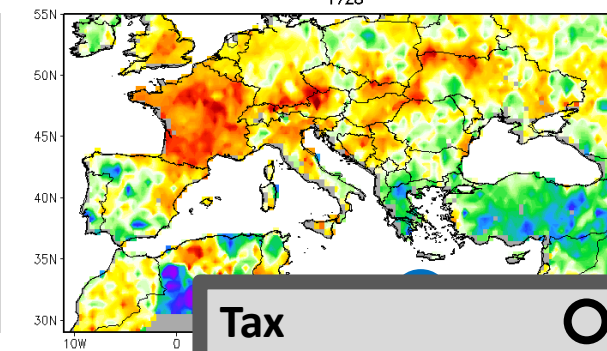
Reconstructed JJA PDSI

1727

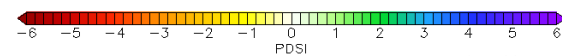


Reconstructed JJA PDSI

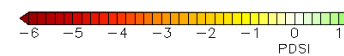
1728



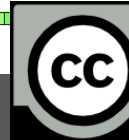
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PDSI

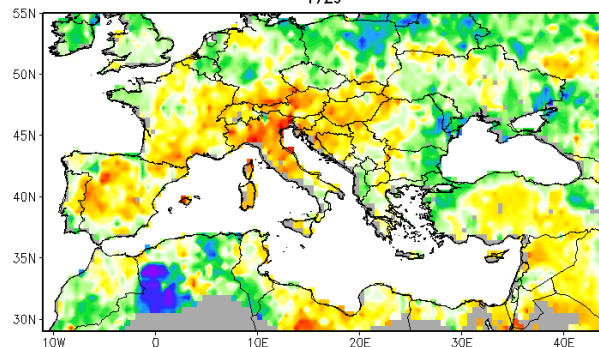


Tax
Organization
Conflict
Disease



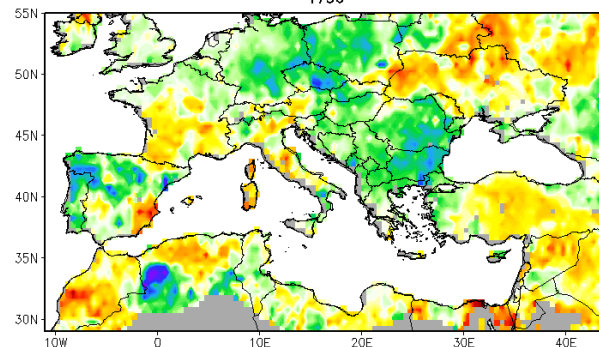
Reconstructed JJA PDSI

1729



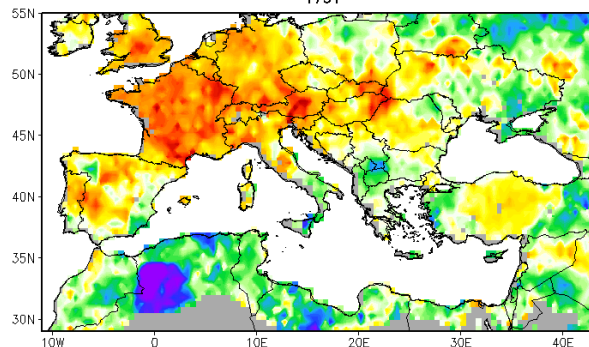
Reconstructed JJA PDSI

1730



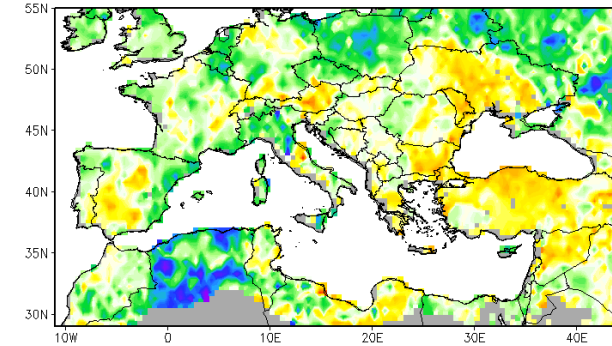
Reconstructed JJA PDSI

1731



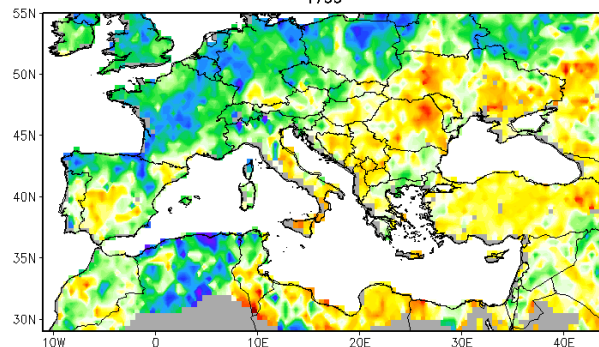
Reconstructed JJA PDSI

1732



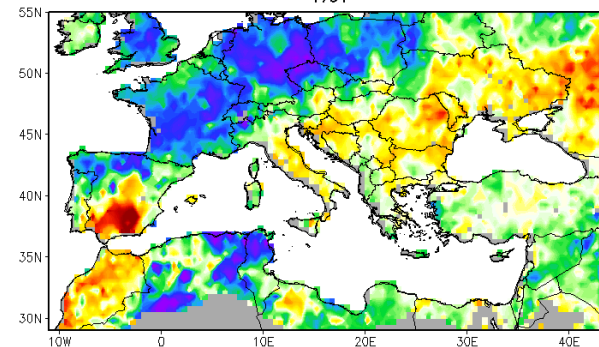
Reconstructed JJA PDSI

1733



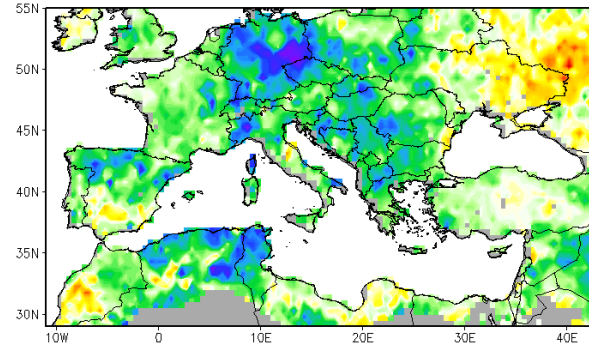
Reconstructed JJA PDSI

1734



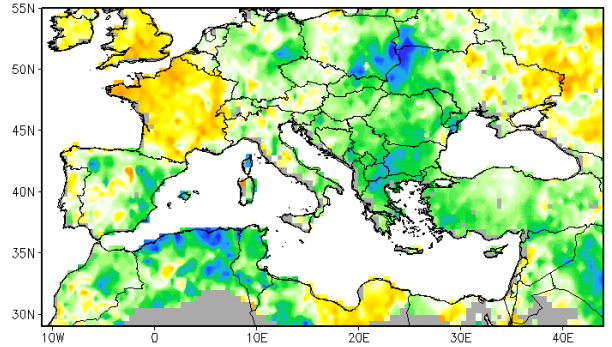
Reconstructed JJA PDSI

1735



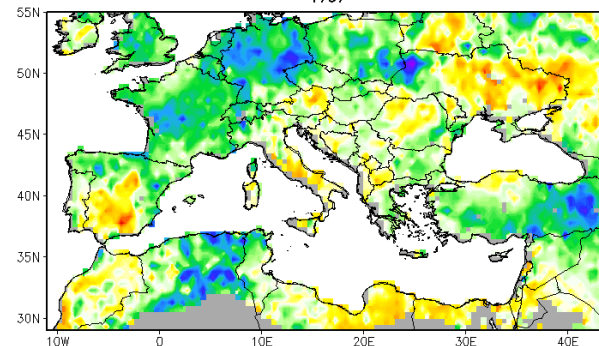
Reconstructed JJA PDSI

1736



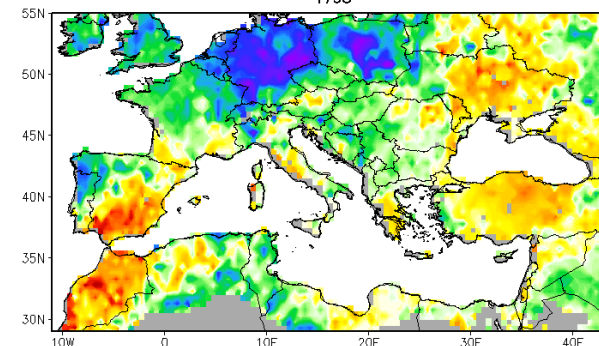
Reconstructed JJA PDSI

1737



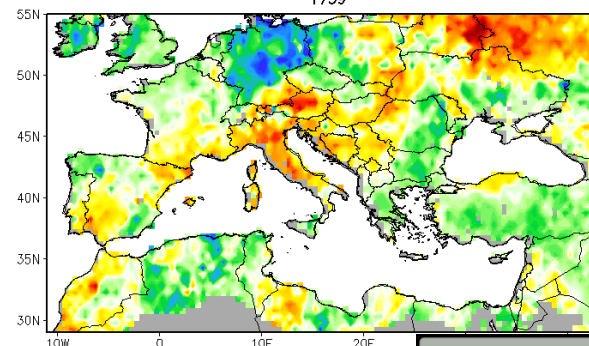
Reconstructed JJA PDSI

1738



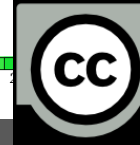
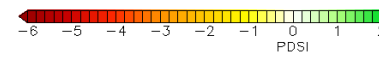
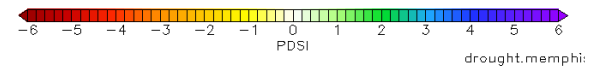
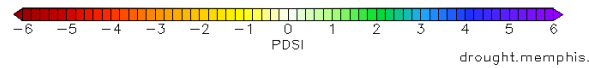
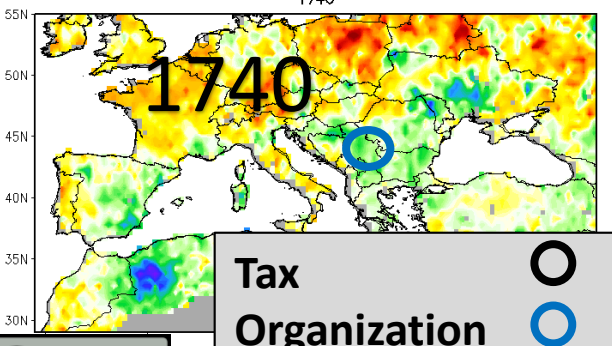
Reconstructed JJA PDSI

1739



Reconstructed JJA PDSI

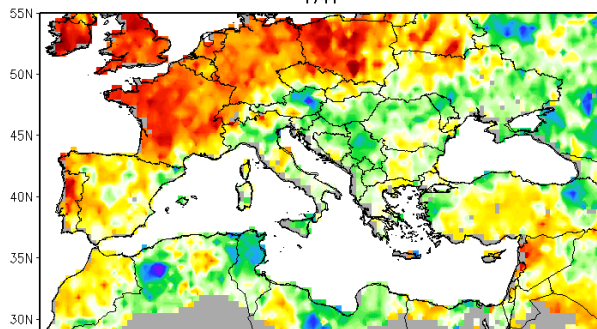
1740



Tax
Organization
Conflict
Disease

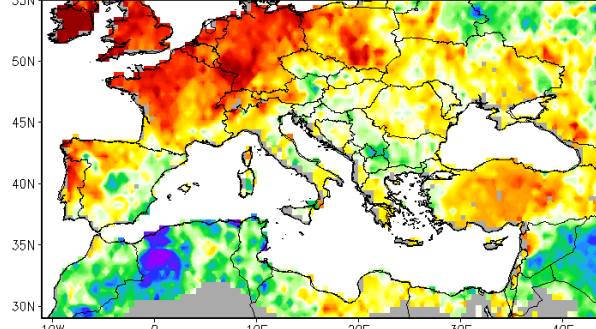


1741



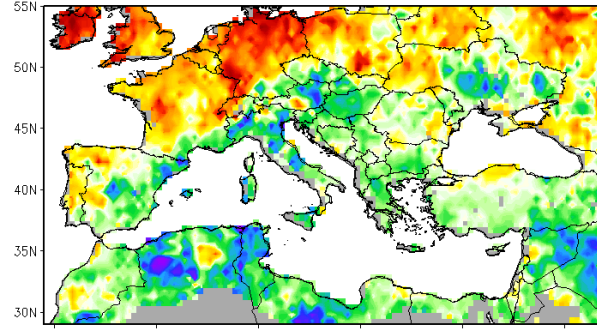
Reconstructed JJA PDSI

1742



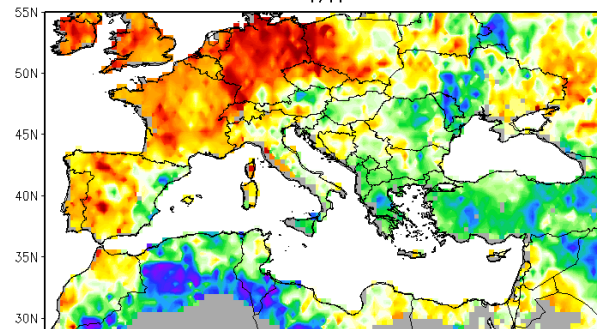
Reconstructed JJA PDSI

1743



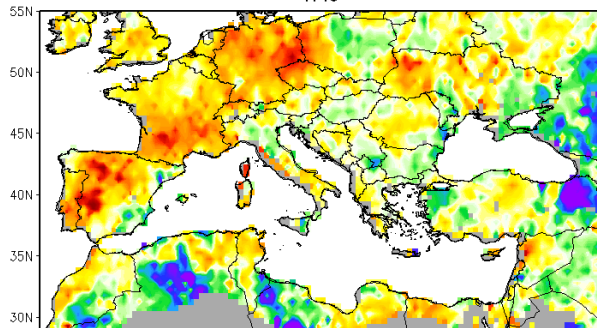
Reconstructed JJA PDSI

1744



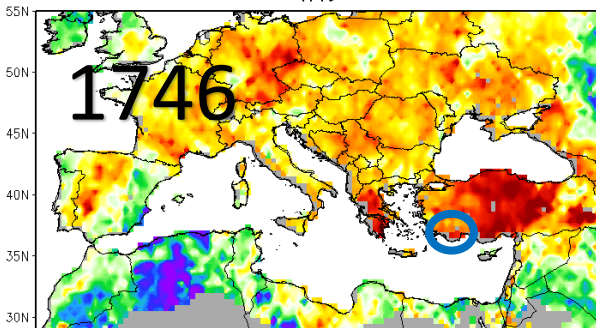
Reconstructed JJA PDSI

1745



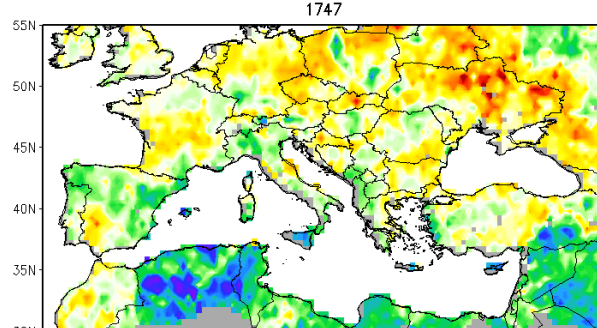
Reconstructed JJA PDSI

1746



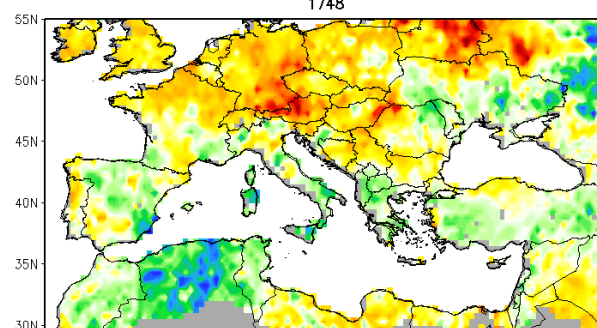
Reconstructed JJA PDSI

1747



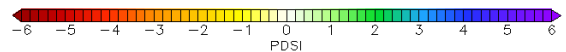
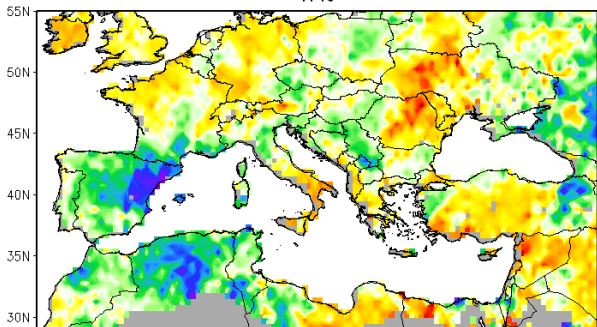
Reconstructed JJA PDSI

1748



Reconstructed JJA PDSI

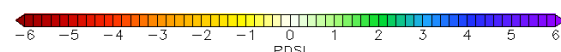
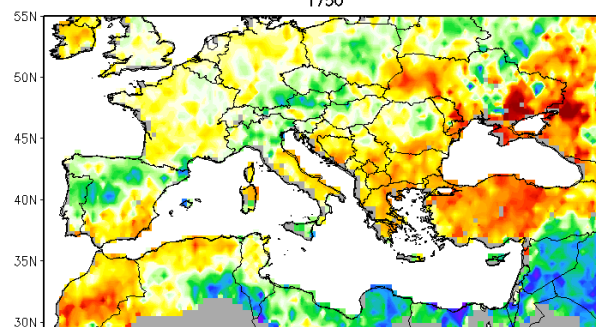
1749



PDSI

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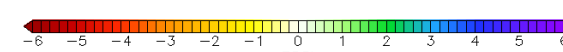
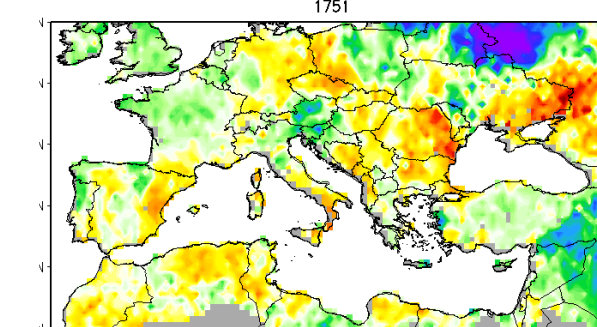
1750



PDSI

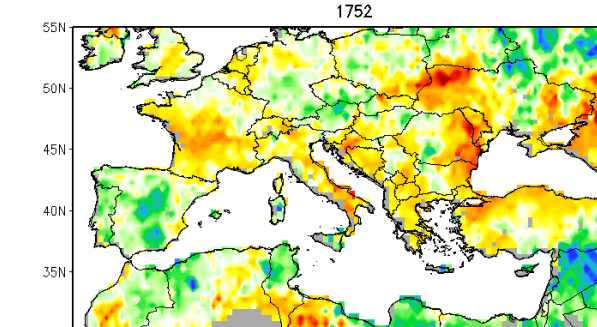
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1751



PDSI

1752



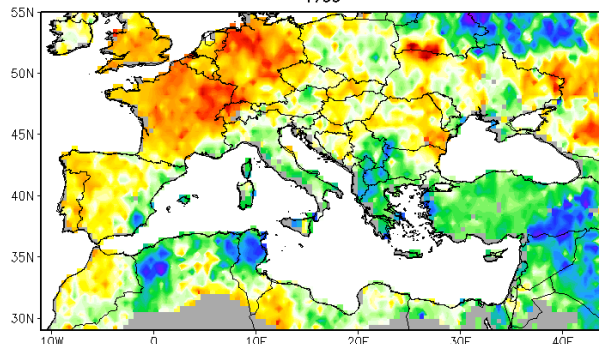
PDSI

Tax
Organization
Conflict
Disease



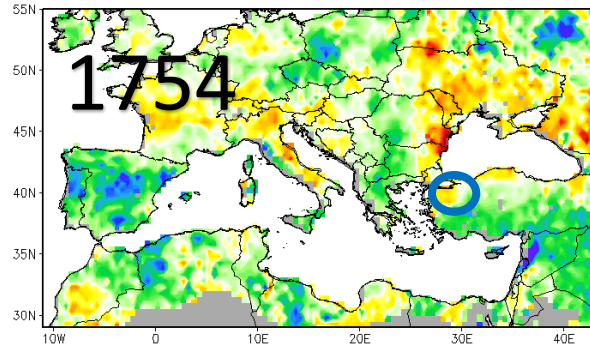
Reconstructed JJA PDSI

1753



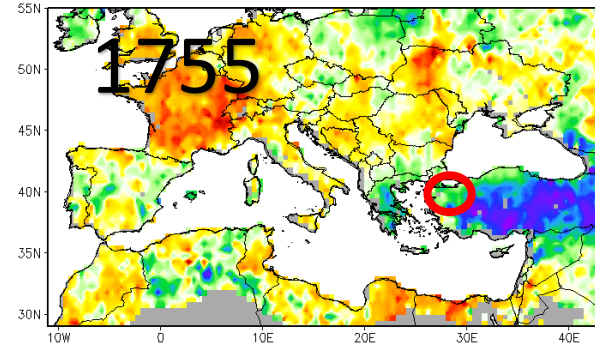
Reconstructed JJA PDSI

1754



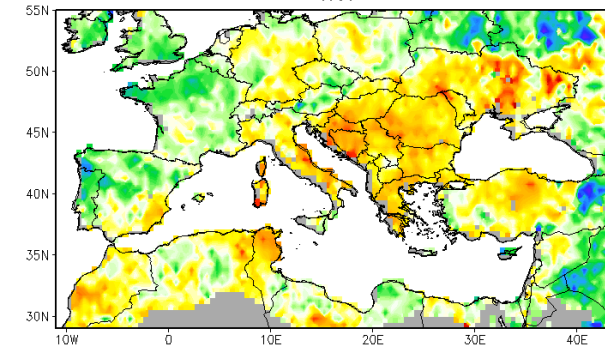
Reconstructed JJA PDSI

1755



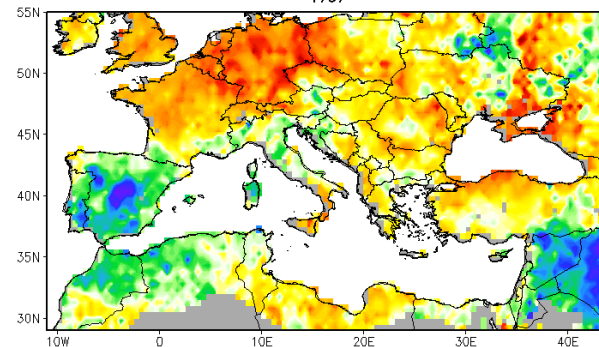
Reconstructed JJA PDSI

1756



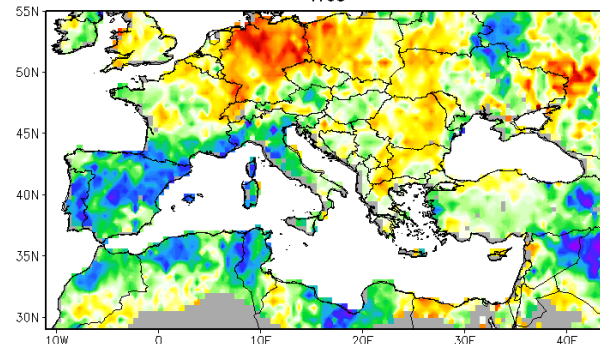
Reconstructed JJA PDSI

1757



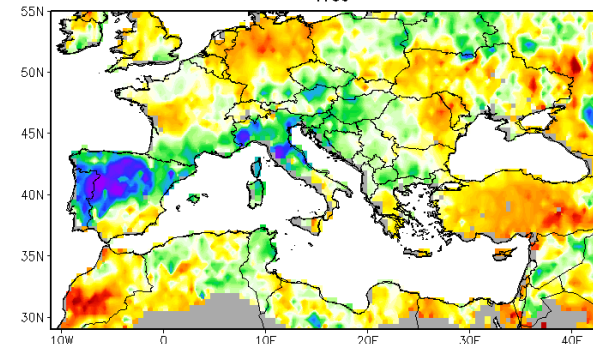
Reconstructed JJA PDSI

1758



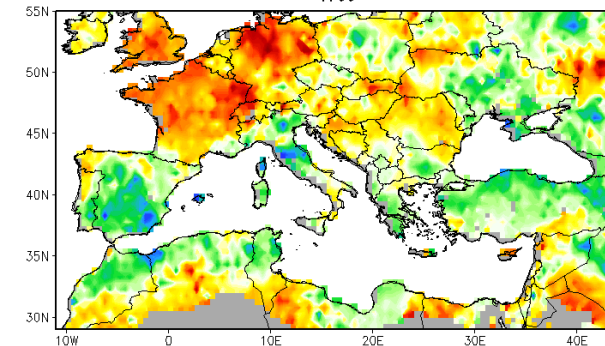
Reconstructed JJA PDSI

1759



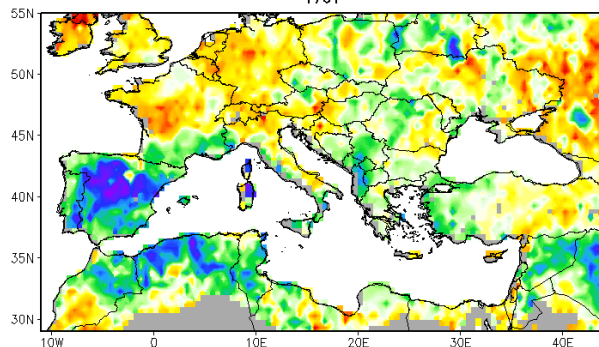
Reconstructed JJA PDSI

1760



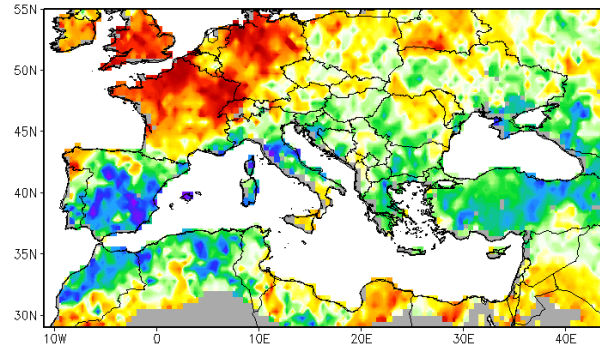
Reconstructed JJA PDSI

1761



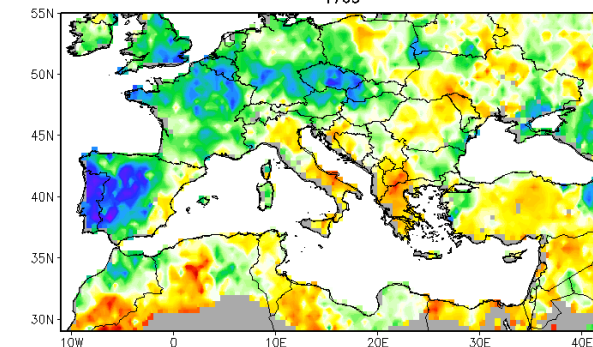
Reconstructed JJA PDSI

1762



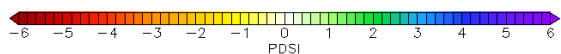
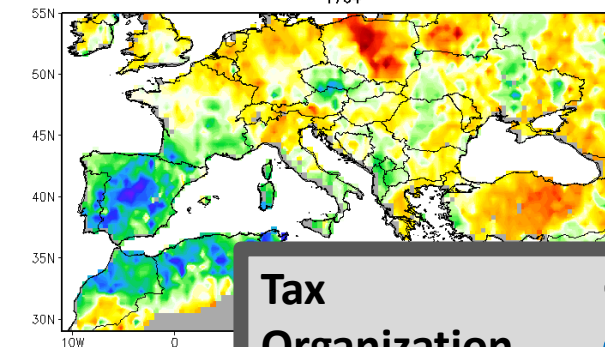
Reconstructed JJA PDSI

1763

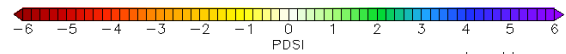


Reconstructed JJA PDSI

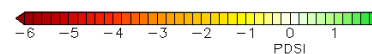
1764



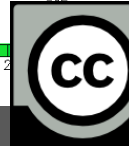
drought.memph



drought.memphis.e



PDSI

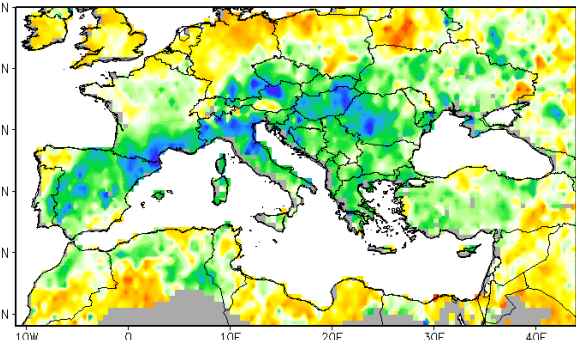


Tax
Organization
Conflict
Disease



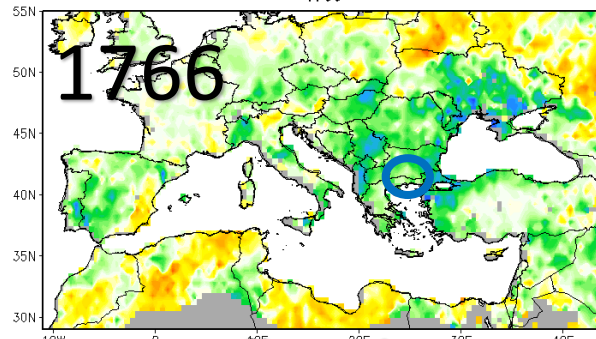
Reconstructed JJA PDSI

1765



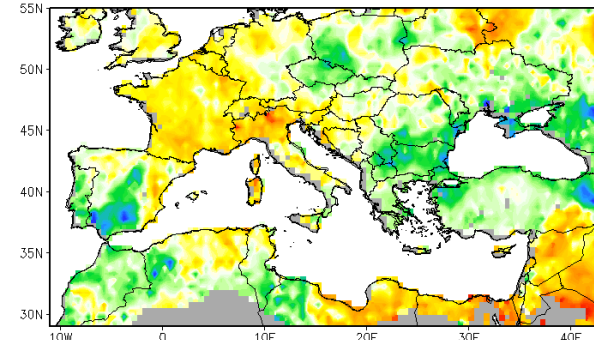
Reconstructed JJA PDSI

1766



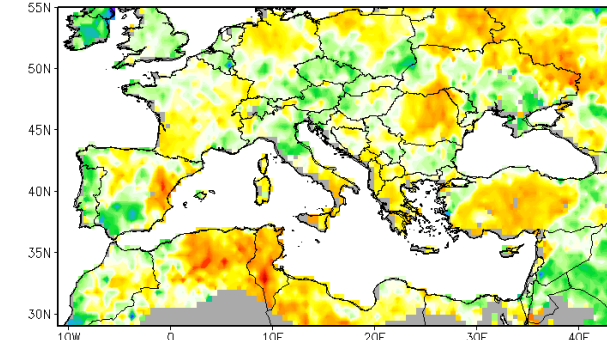
Reconstructed JJA PDSI

1767



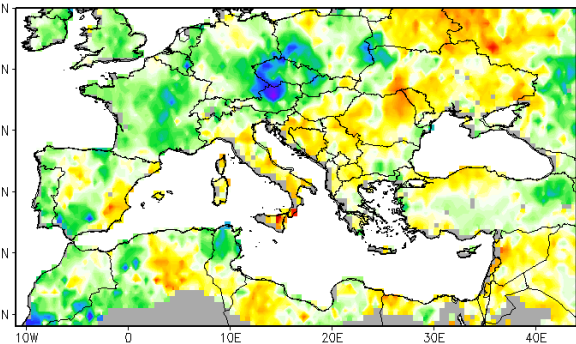
Reconstructed JJA PDSI

1768



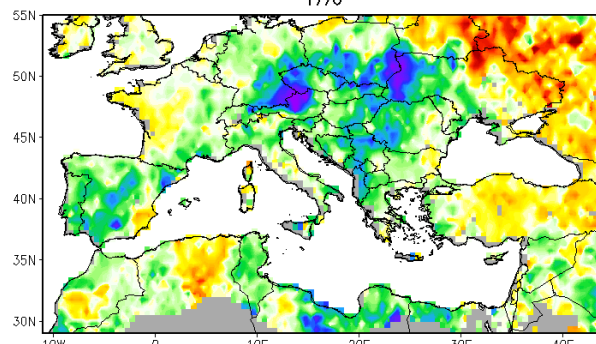
Reconstructed JJA PDSI

1769



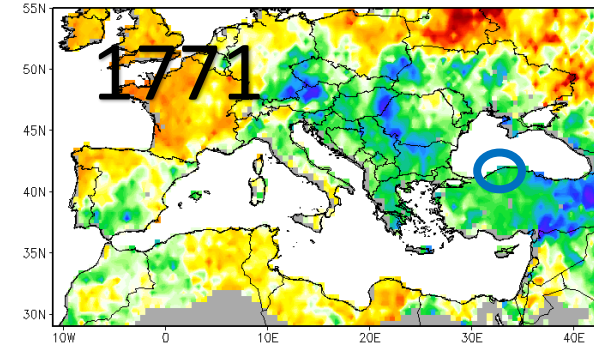
Reconstructed JJA PDSI

1770



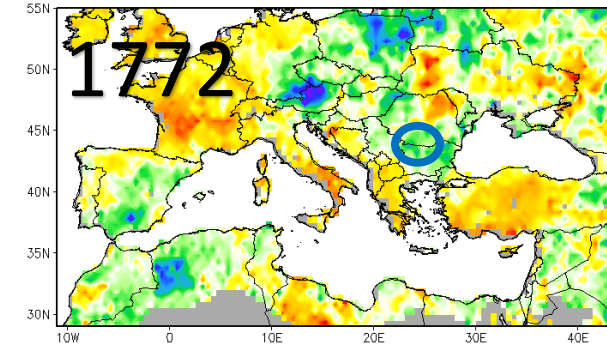
Reconstructed JJA PDSI

1771



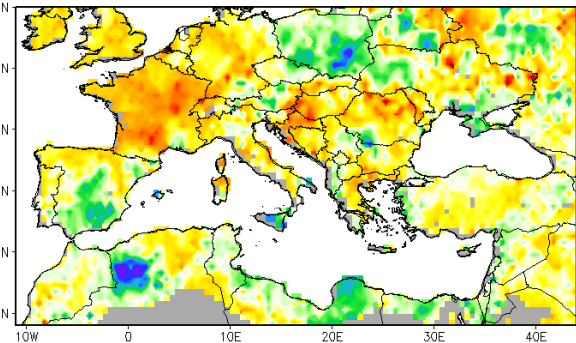
Reconstructed JJA PDSI

1772



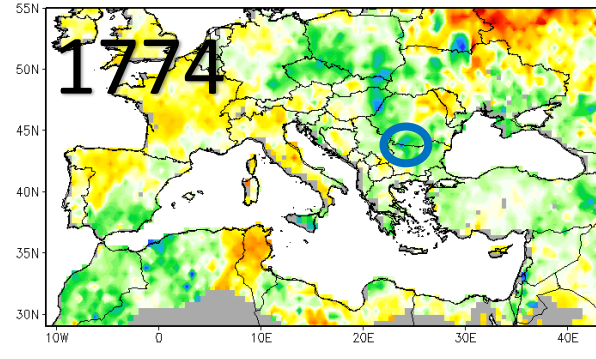
Reconstructed JJA PDSI

1773



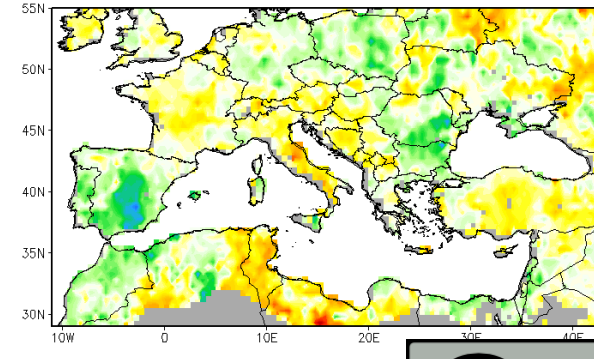
Reconstructed JJA PDSI

1774



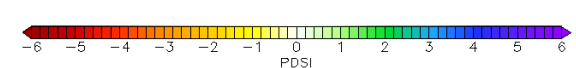
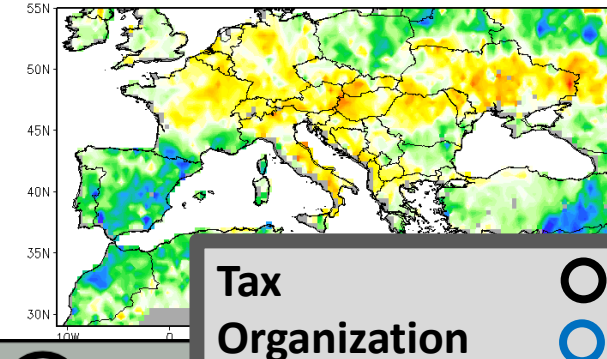
Reconstructed JJA PDSI

1775

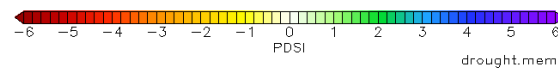


Reconstructed JJA PDSI

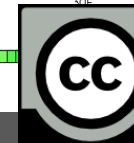
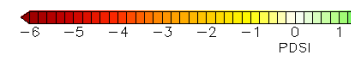
1776



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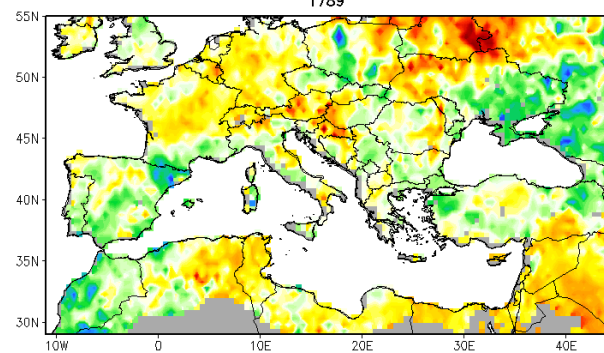


Tax
Organization
Conflict
Disease



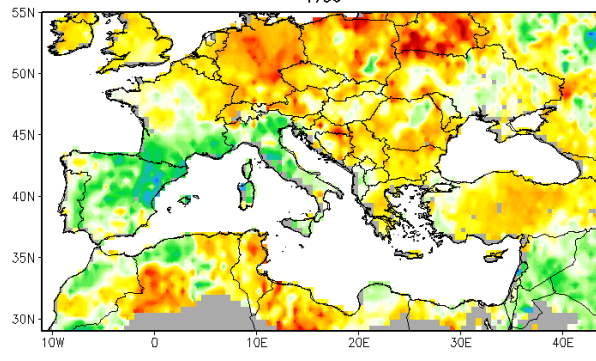
Reconstructed JJA PDSI

1789



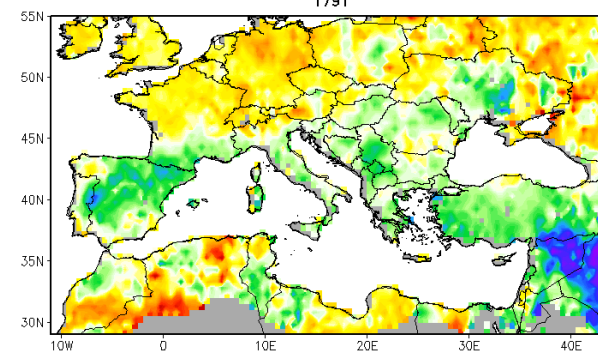
Reconstructed JJA PDSI

1790



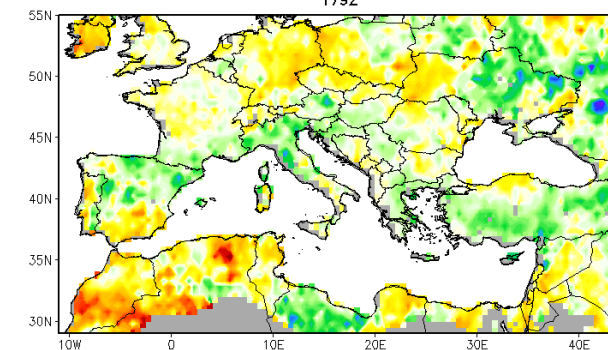
Reconstructed JJA PDSI

1791



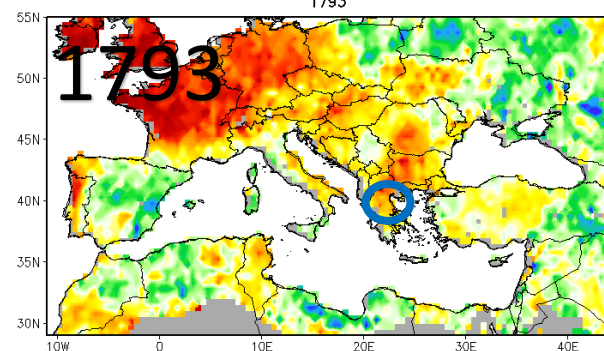
Reconstructed JJA PDSI

1792



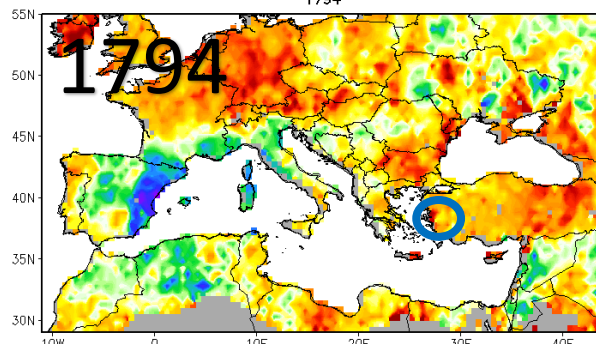
Reconstructed JJA PDSI

1793



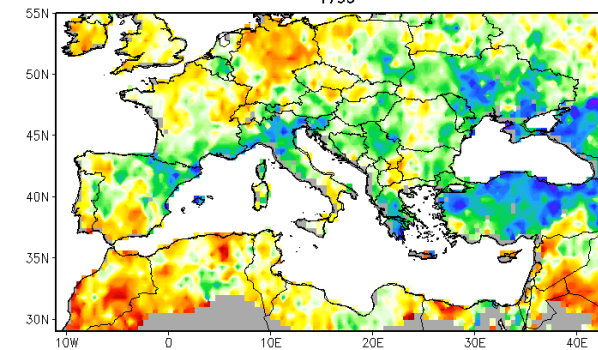
Reconstructed JJA PDSI

1794



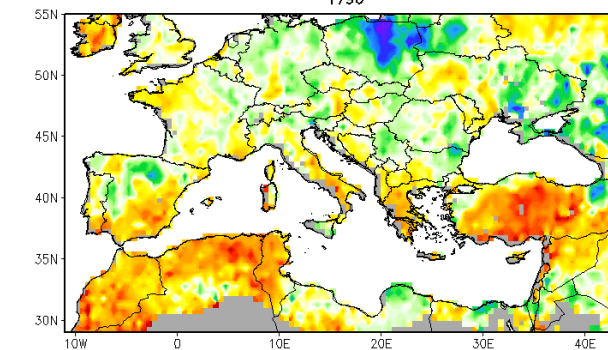
Reconstructed JJA PDSI

1795



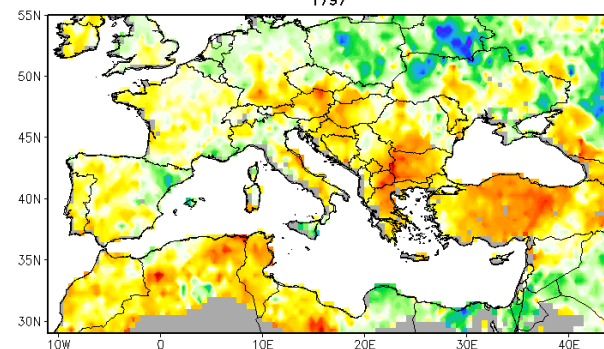
Reconstructed JJA PDSI

1796



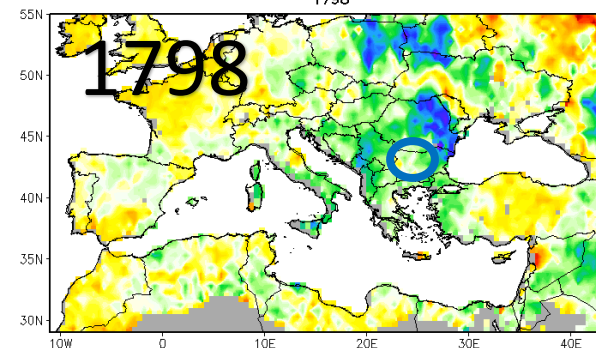
Reconstructed JJA PDSI

1797



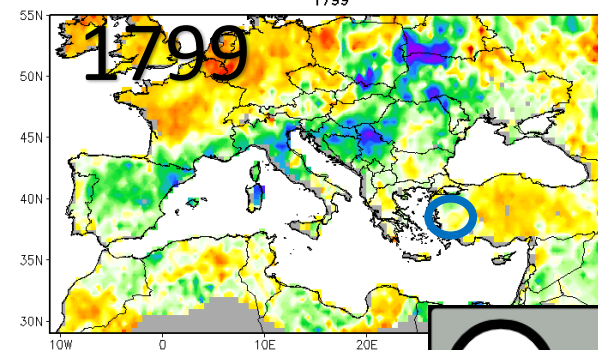
Reconstructed JJA PDSI

1798



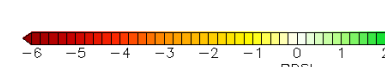
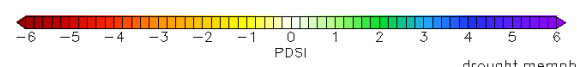
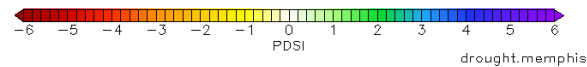
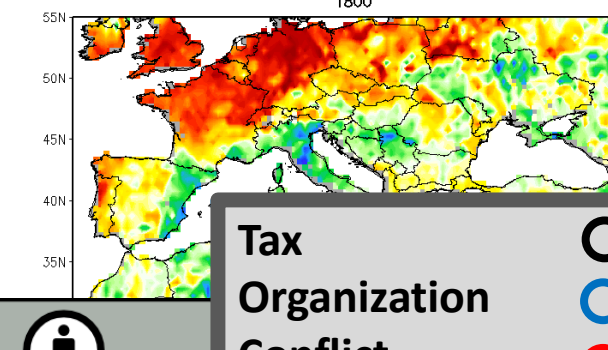
Reconstructed JJA PDSI

1799



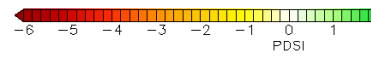
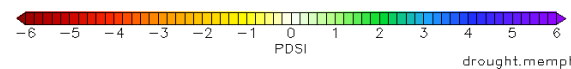
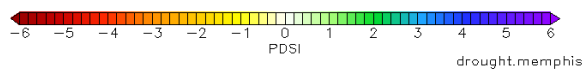
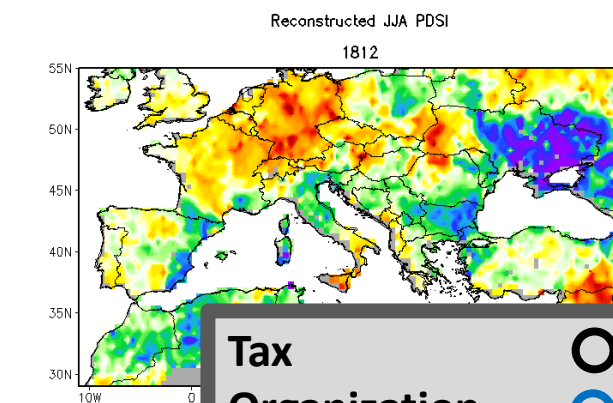
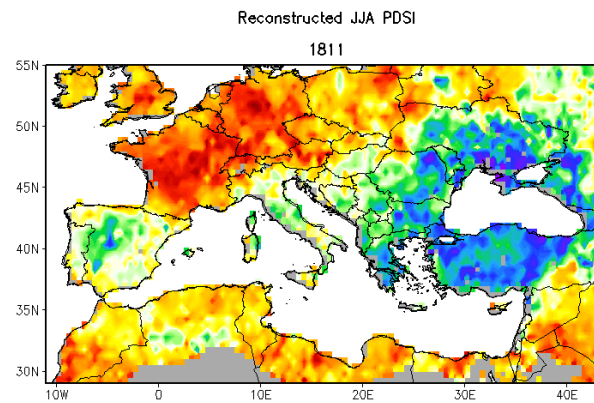
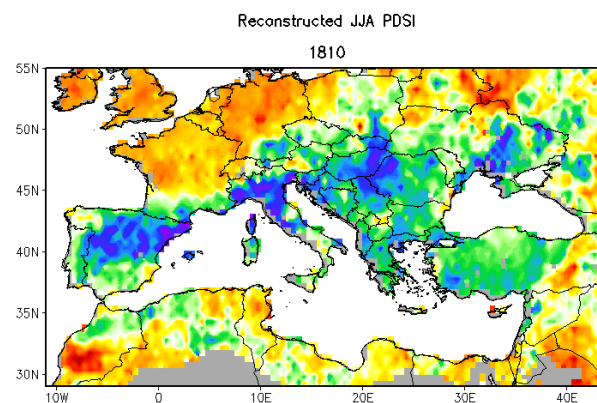
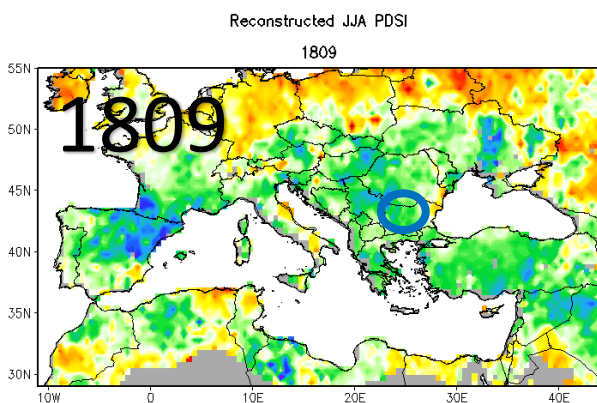
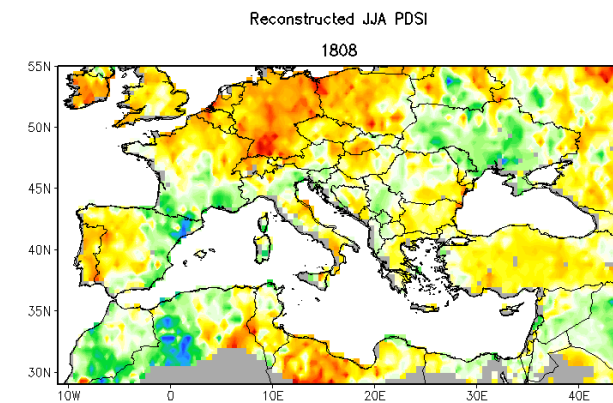
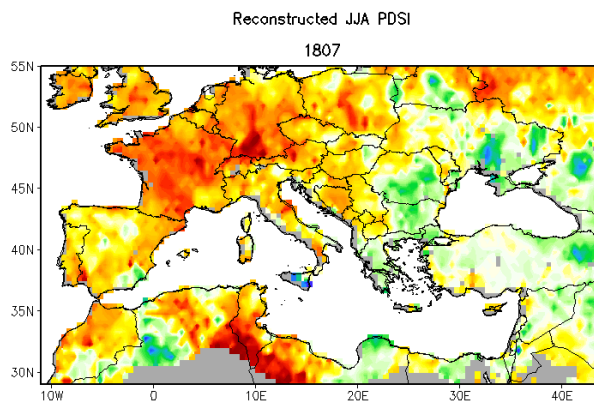
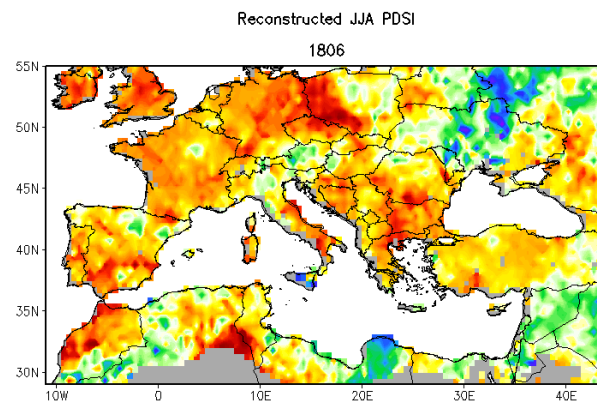
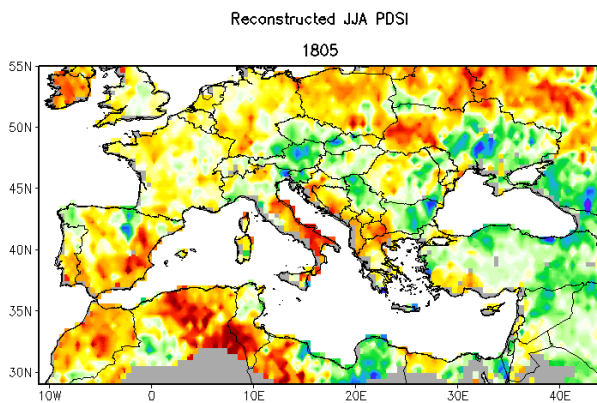
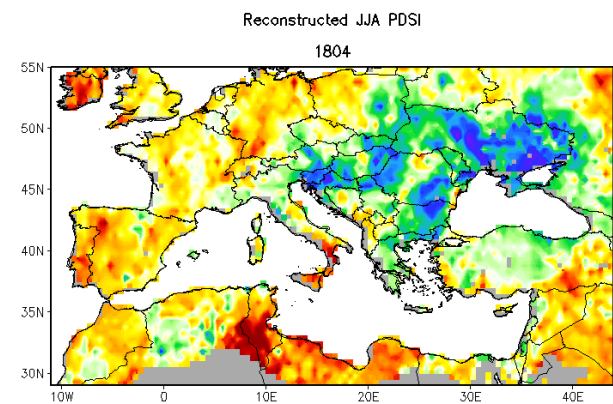
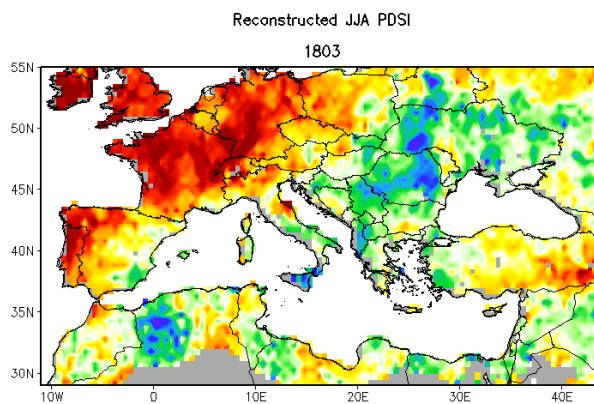
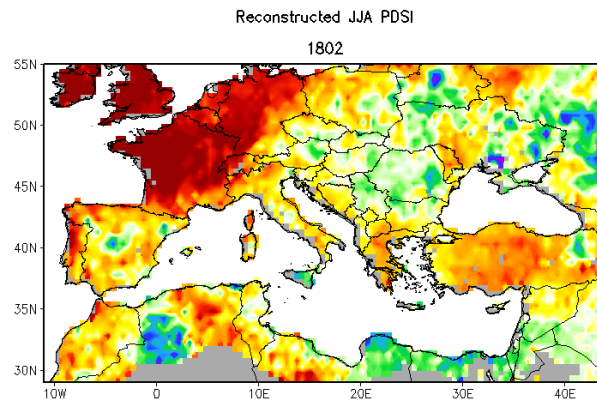
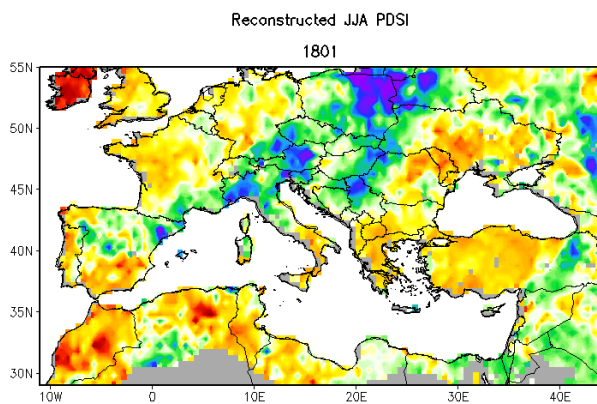
Reconstructed JJA PDSI

1800



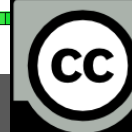
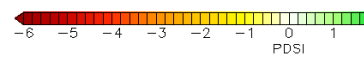
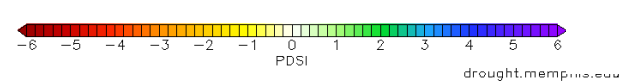
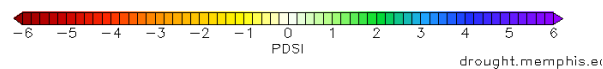
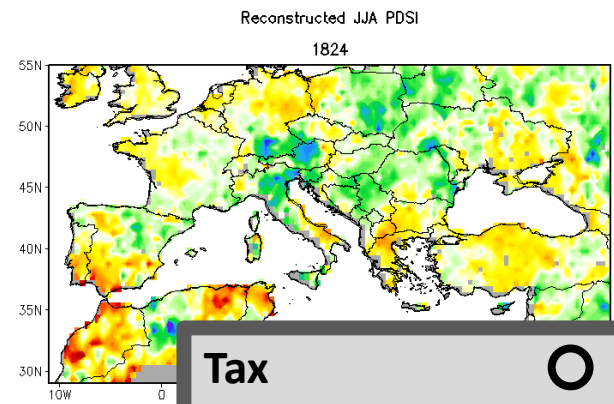
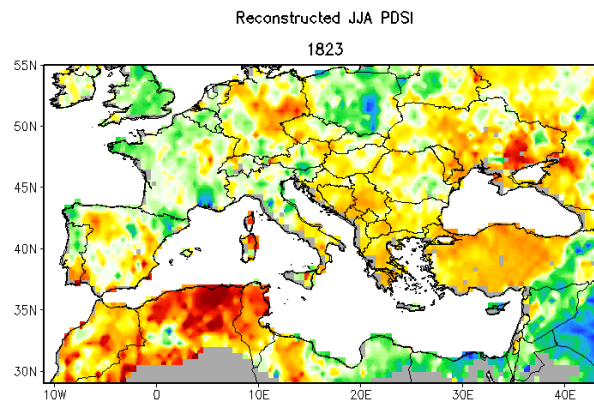
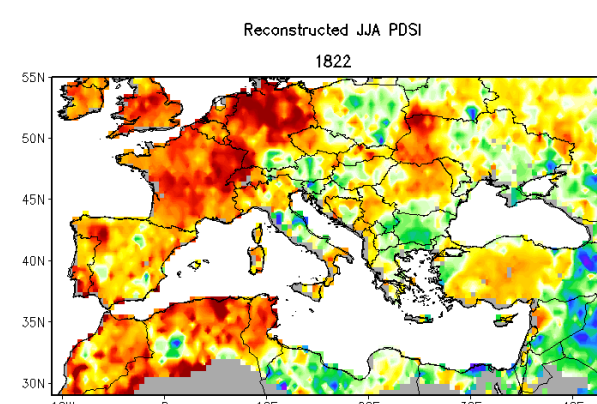
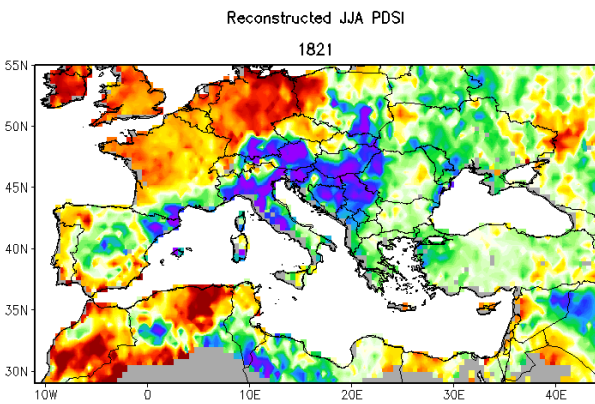
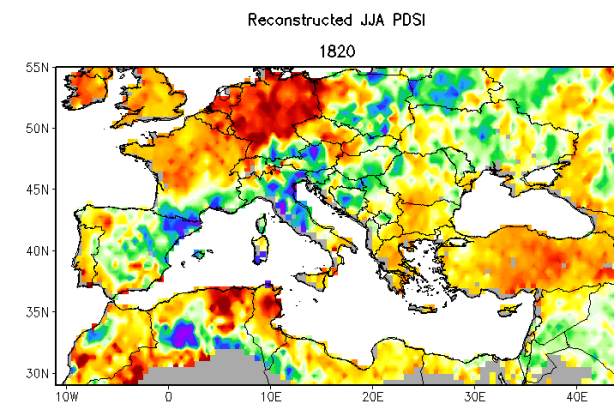
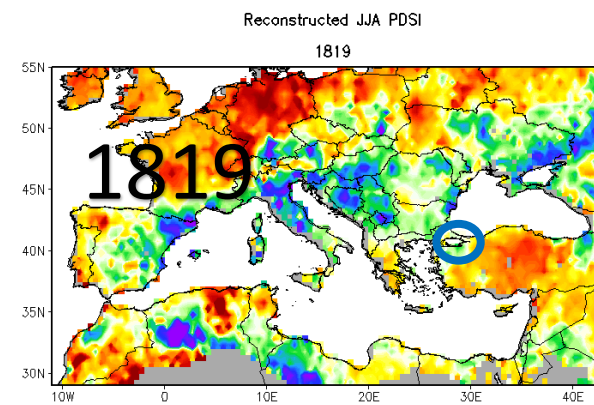
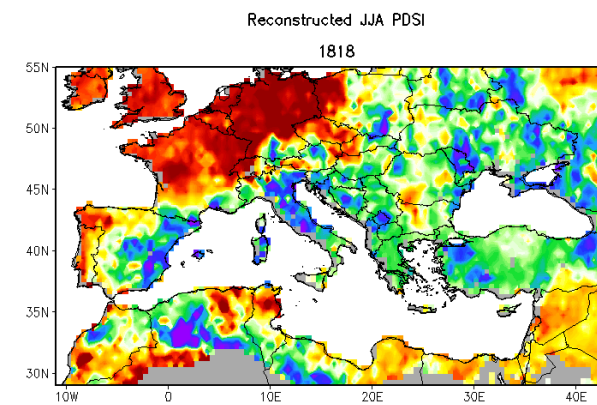
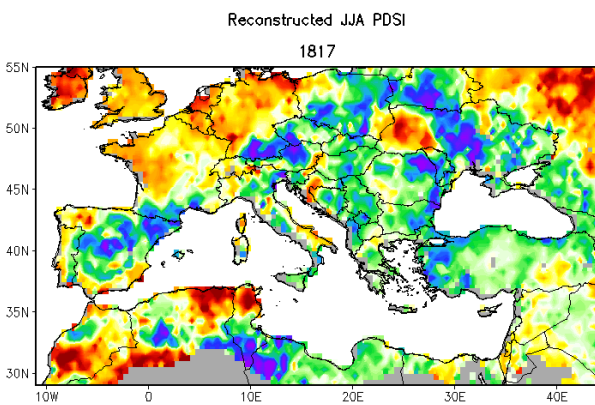
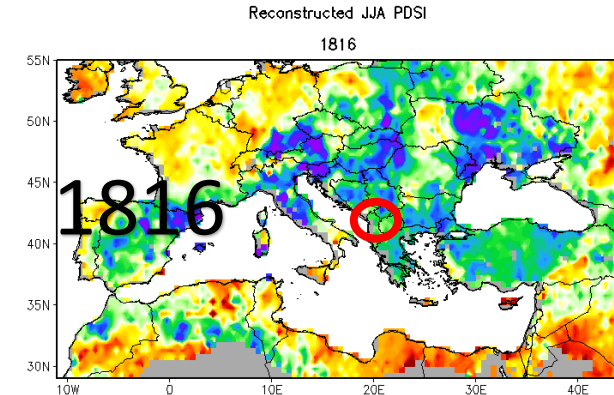
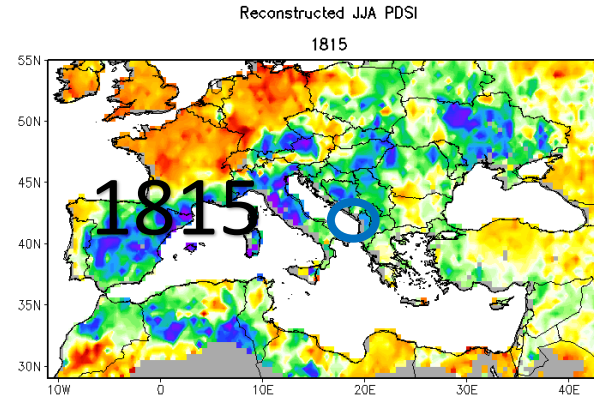
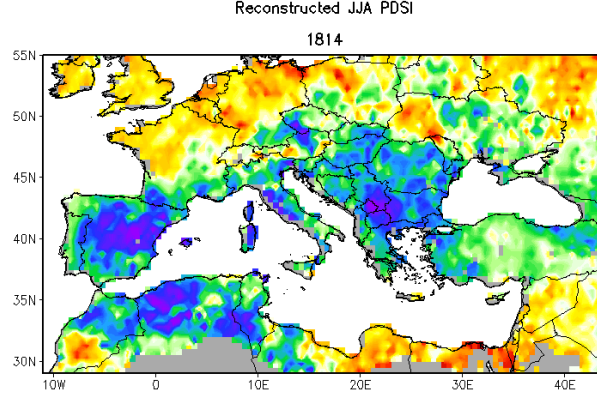
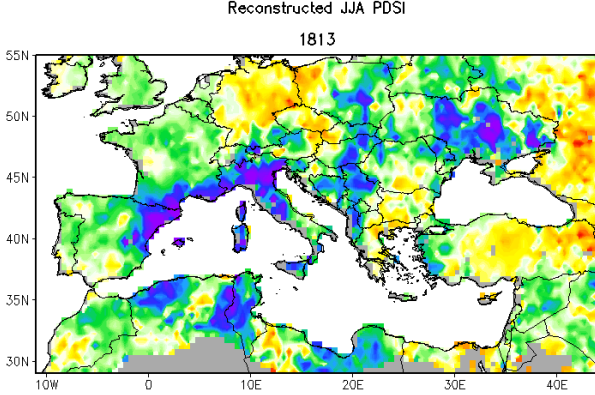
Tax
Organization
Conflict
Disease





Tax
Organization
Conflict
Disease



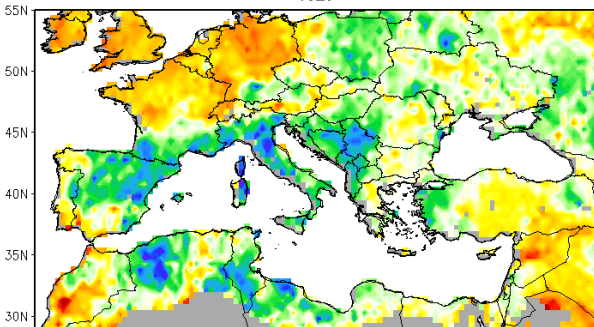


Tax
Organization
Conflict
Disease



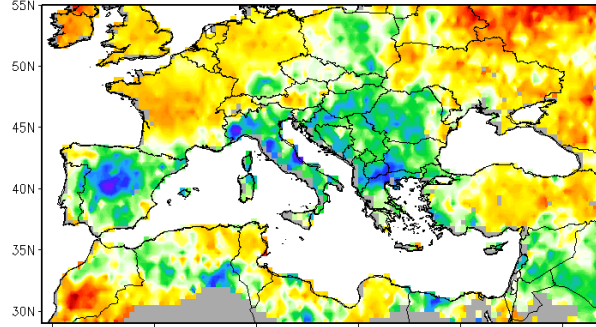
Reconstructed JJA PDSI

1825



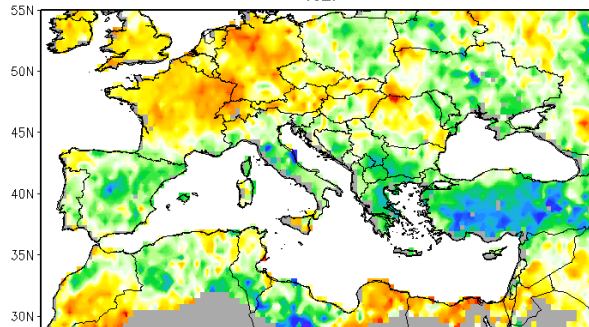
Reconstructed JJA PDSI

1826



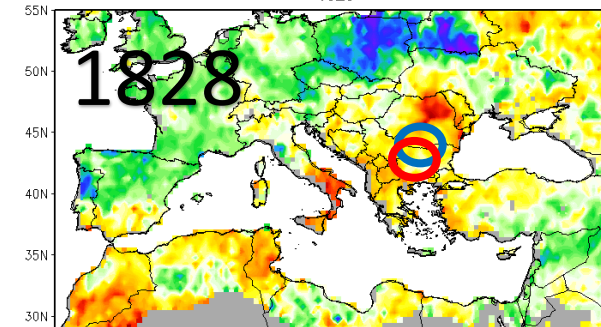
Reconstructed JJA PDSI

1827



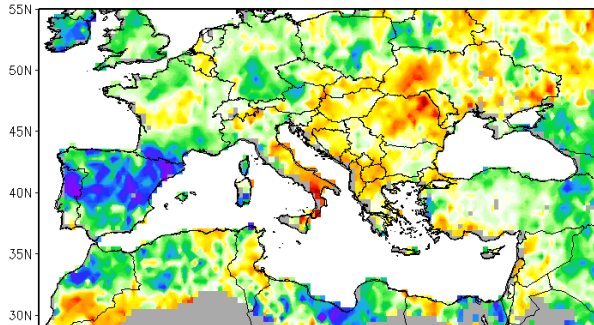
Reconstructed JJA PDSI

1828



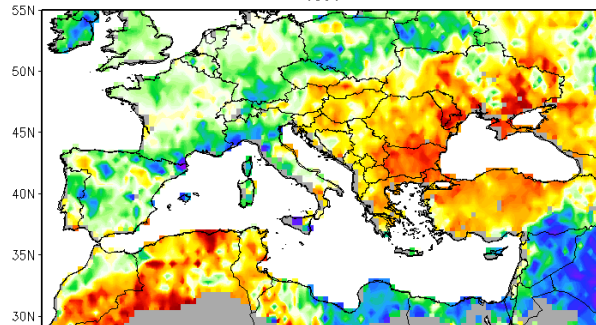
Reconstructed JJA PDSI

1829



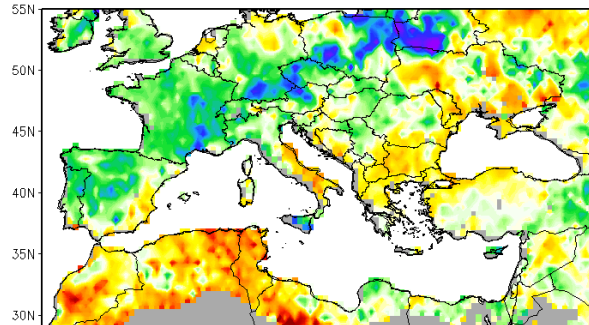
Reconstructed JJA PDSI

1830



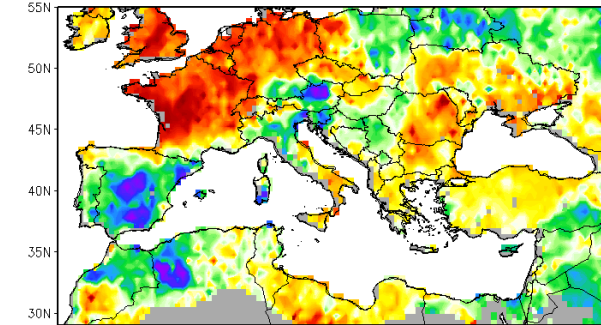
Reconstructed JJA PDSI

1831



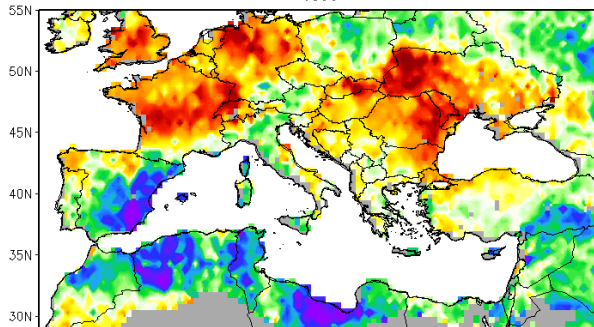
Reconstructed JJA PDSI

1832



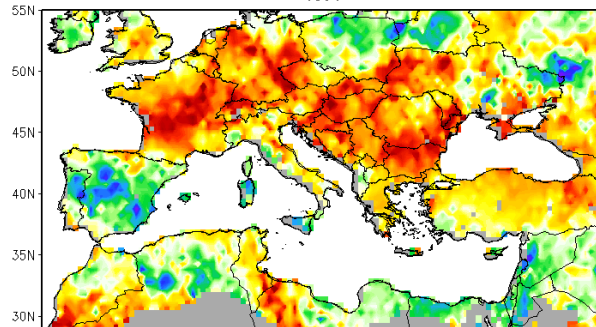
Reconstructed JJA PDSI

1833



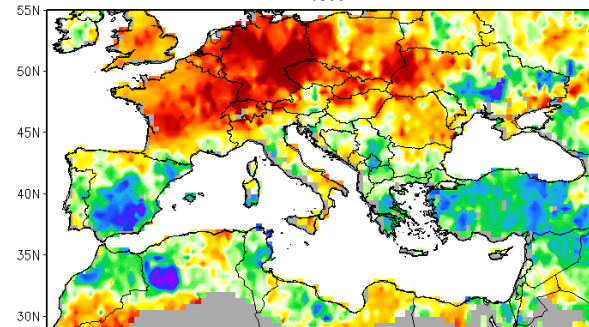
Reconstructed JJA PDSI

1834



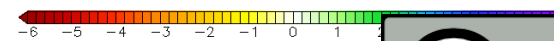
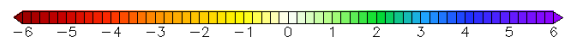
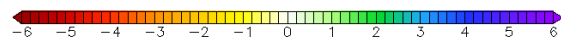
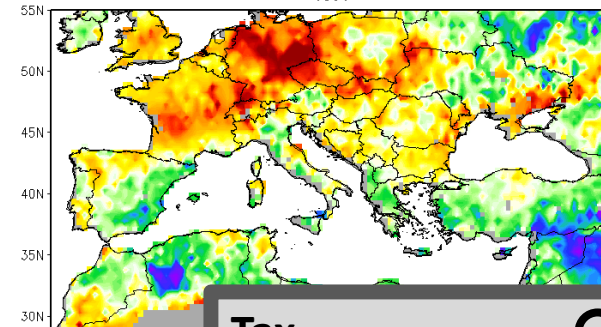
Reconstructed JJA PDSI

1835



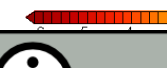
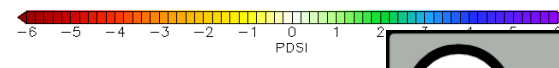
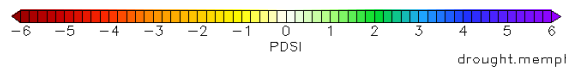
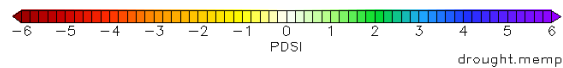
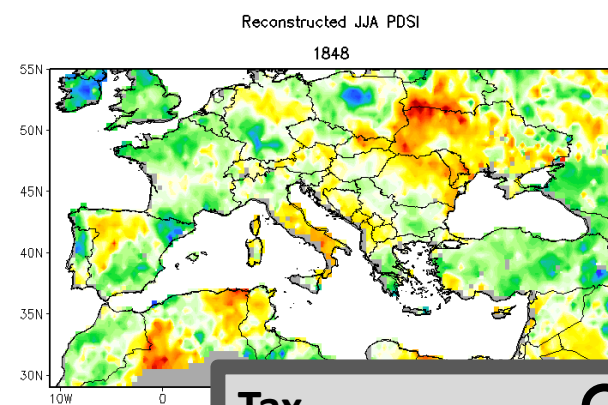
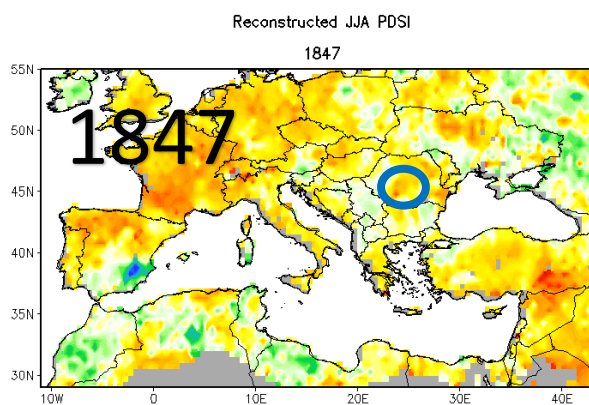
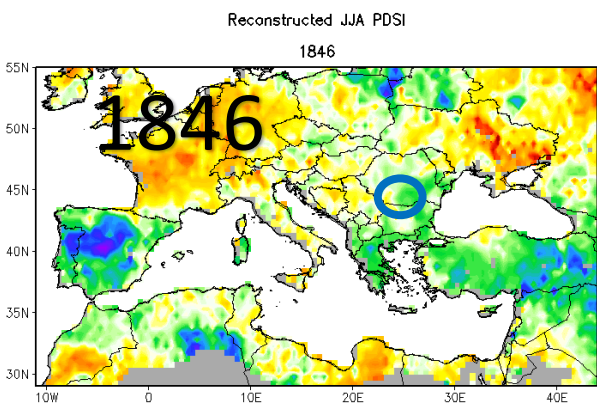
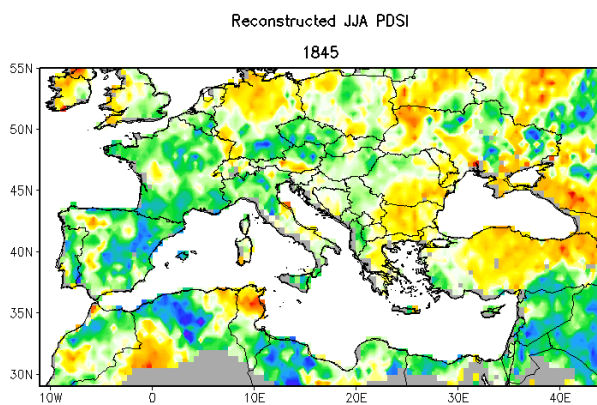
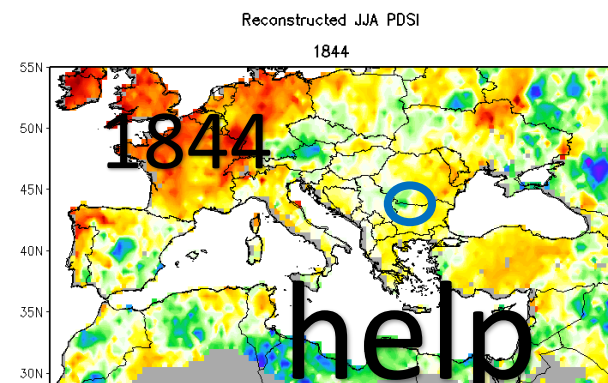
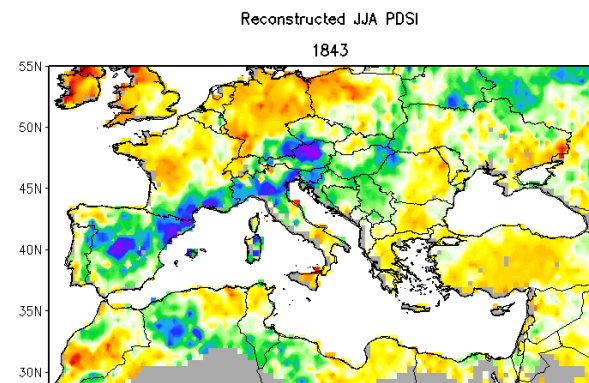
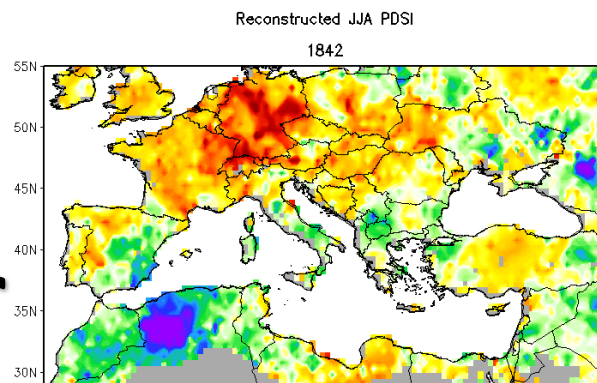
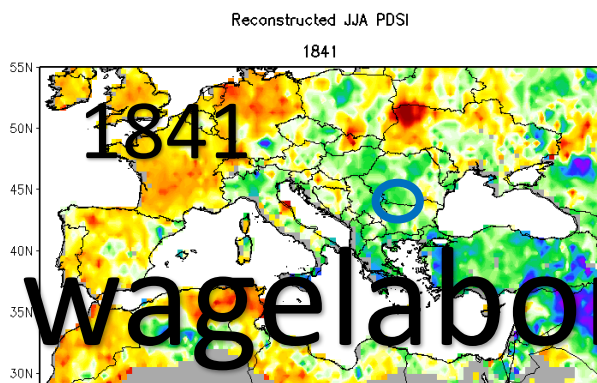
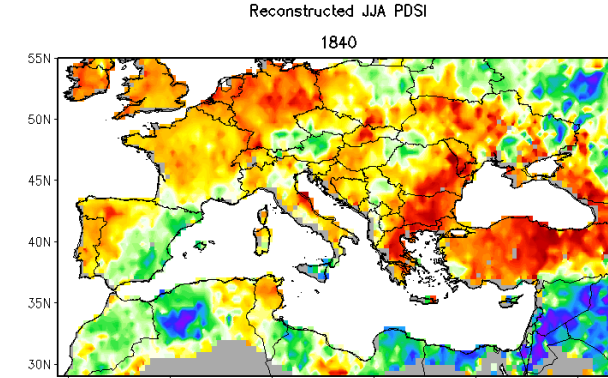
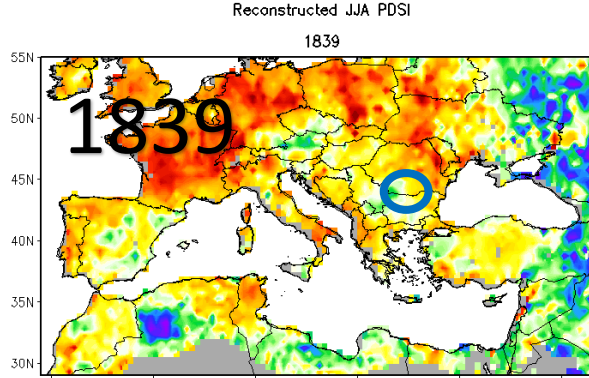
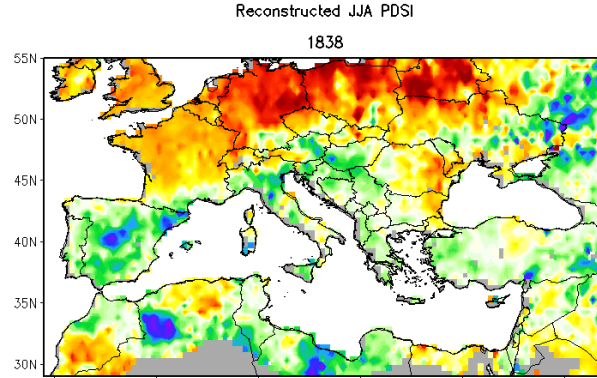
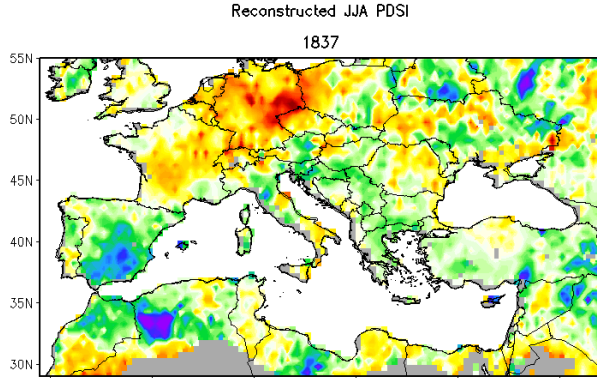
Reconstructed JJA PDSI

1836



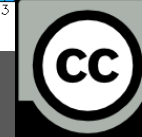
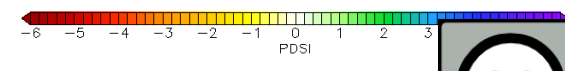
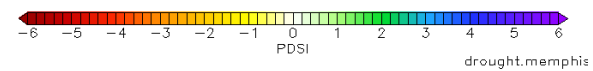
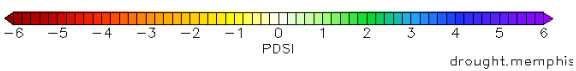
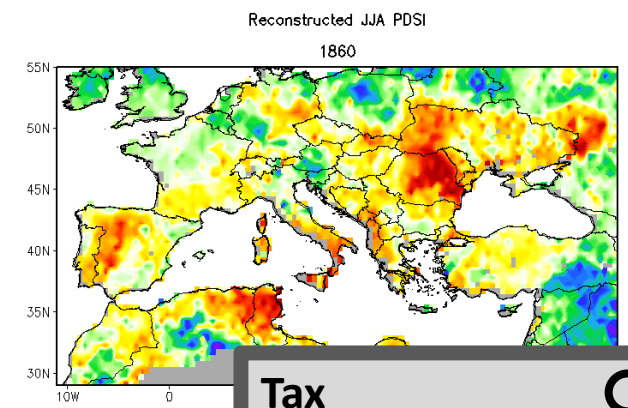
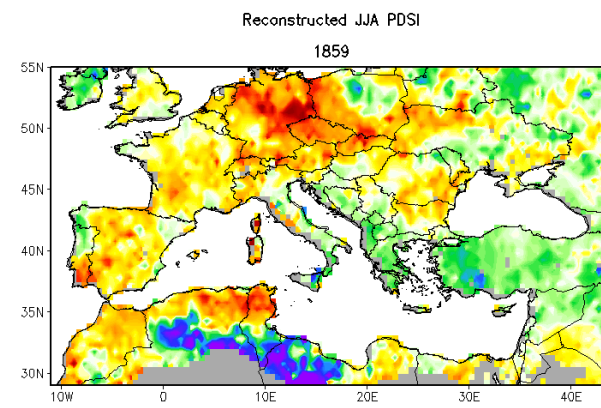
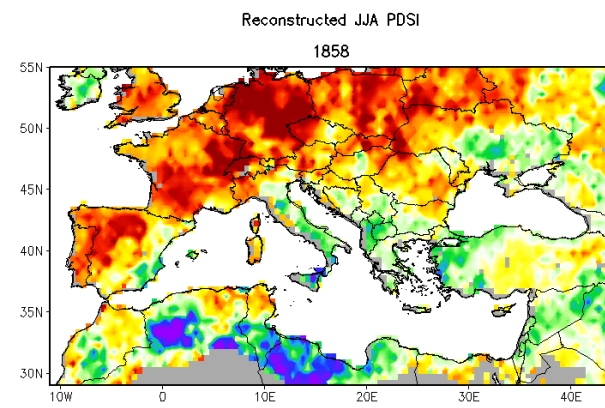
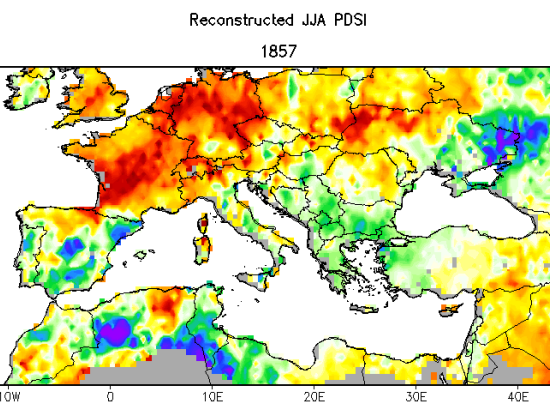
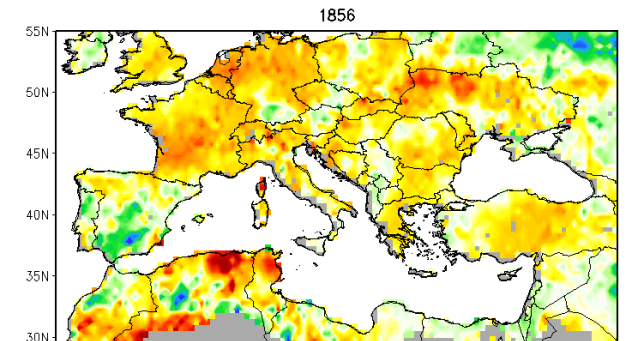
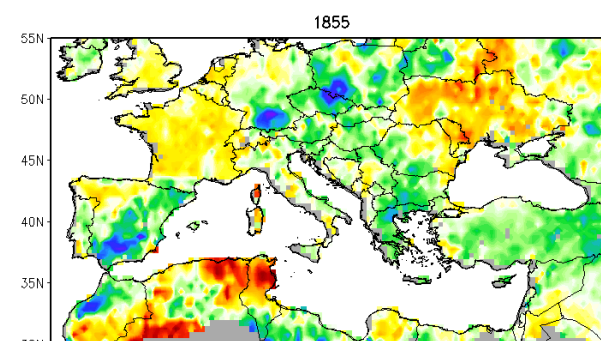
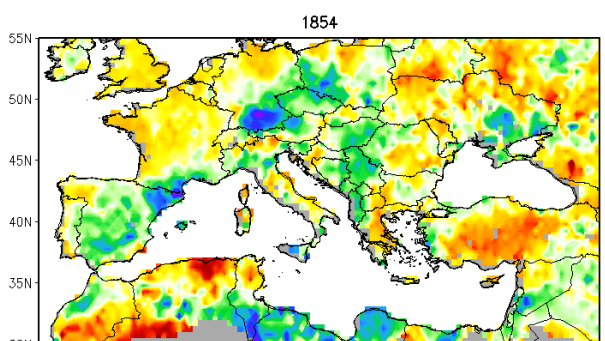
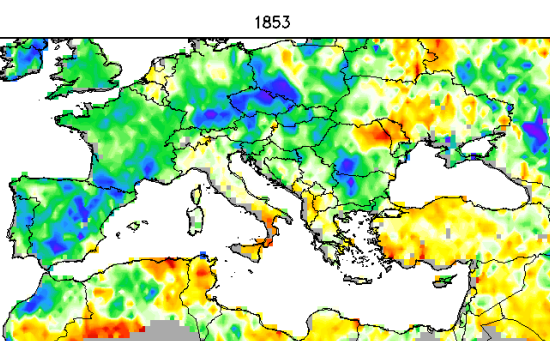
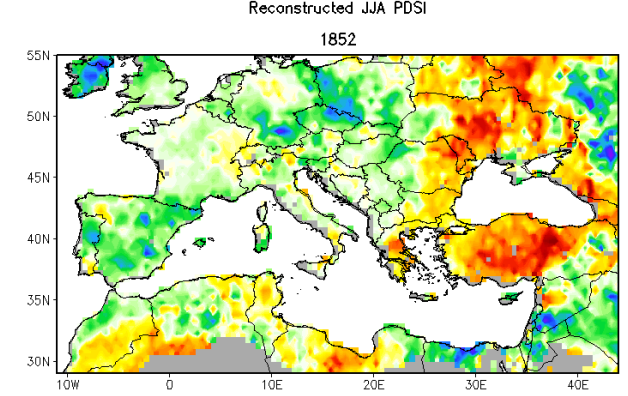
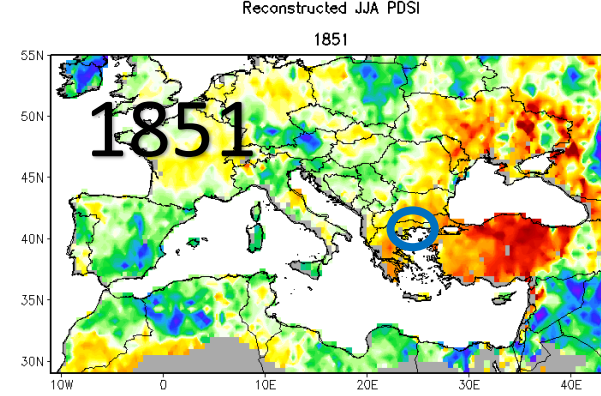
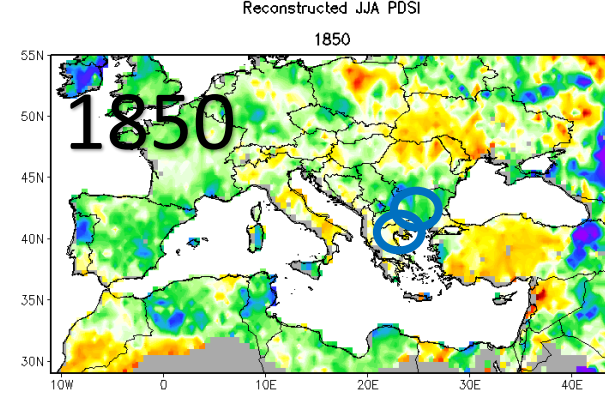
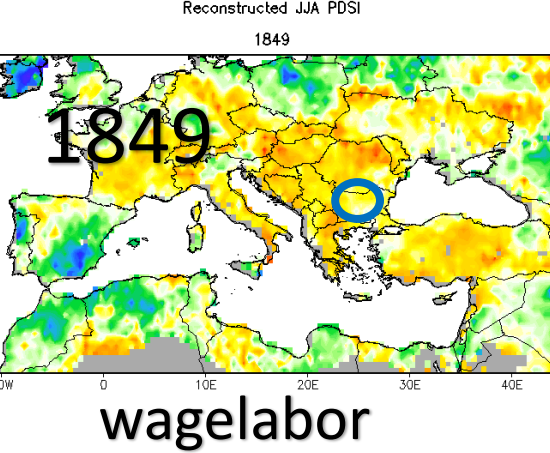
Tax
Organization
Conflict
Disease





Tax
Organization
Conflict
Disease





Tax
Organization
Conflict
Disease

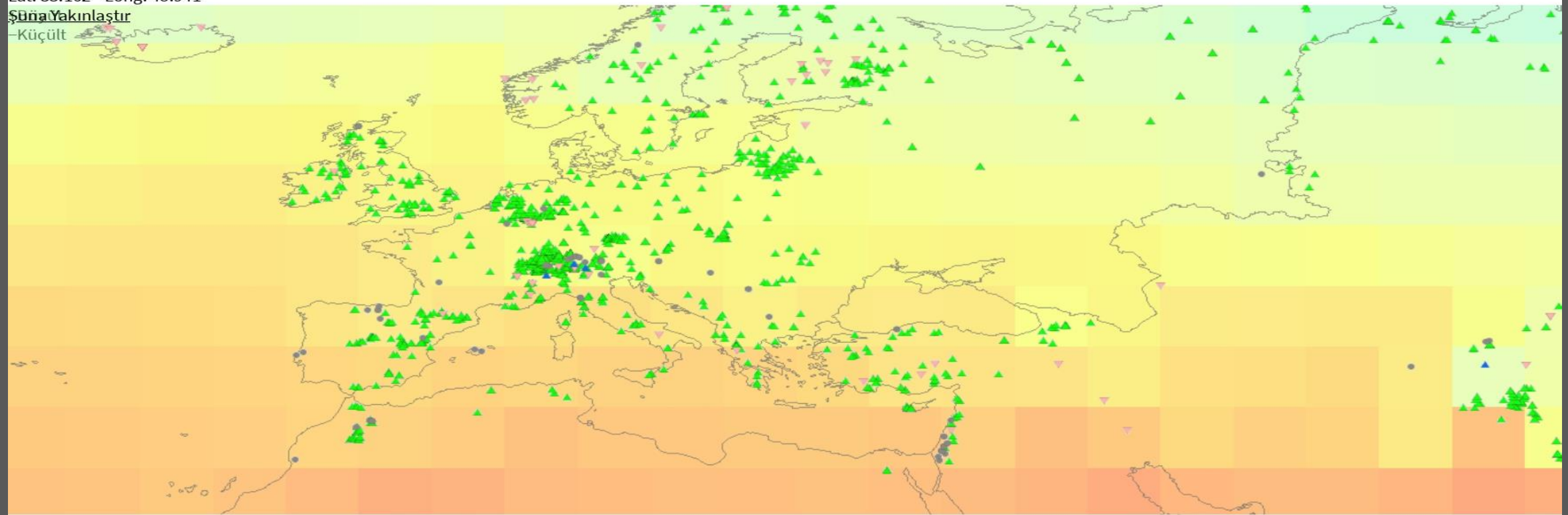


Paleoclimatology Data Map

Lat. 55.162° Long. 48.941°

Şirina Yakınlaştır

-Küçült



600km

400mi

For South East Europe, we not only have less tree ring data, but we also have very few speleothems, paleolimnology and pollen data. Ottoman Archive has hundreds of accounting books for building a reliable proxy data.

Avg. Annual Temperatures (1961-1990) i

-58.81°C 29.02°C

Legend Close

Ice Core ▲

Paleolimnology ▼

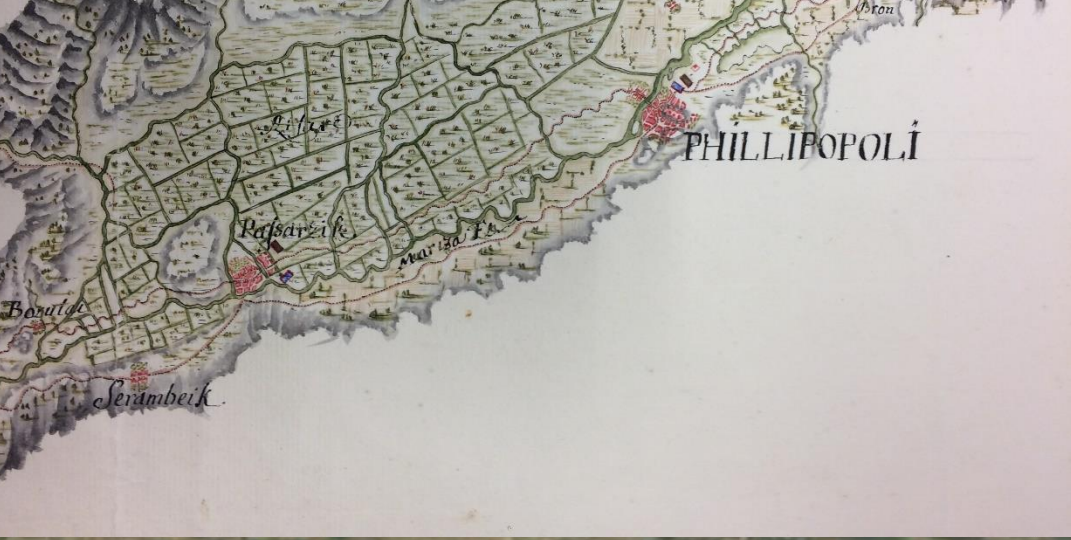
Pollen ●

Speleothem ●

Tree Ring ▲

<https://www.ncdc.noaa.gov/paleo-search/> 2019





Historical maps and documents can help us understand what happened to the landscape.