Biodiversity & Nutrition

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https://modernfarmer.com/2014/02/meat-atlas/
Agricultural centers of origin developed independently in different parts of the world.

- Wheat, Barley, Peas, Grapes: ~13,000 years ago
- Rice, Soybean: ~9,000 years ago
- Maize, Pumpkin, Bean, Potato: ~10,000 years ago

Colors in the map:
- Red: Centres of origin of food production
- Yellow: The most productive agricultural areas of the modern world
Human Population Timeline

THOUSANDS OF YEARS

INDUSTRIAL REVOLUTION

TODAY

POPULATION (BILLIONS)
North American Species believed extinct since 1960s

<table>
<thead>
<tr>
<th>Last Seen</th>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Former Range</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>Columbia Basin Pygmy Rabbit</td>
<td><em>Brachylagrus idahoensis</em> pop. 2</td>
<td>Douglas, Grant, Lincoln, Adams and Benton counties of Washington state</td>
<td>mammal</td>
</tr>
<tr>
<td>1994</td>
<td>Hadley Lake Limnetic Stickleback</td>
<td><em>Gasterosteus</em> sp. 12</td>
<td>Hadley Lake on Lasqueti Island, British Columbia</td>
<td>fish</td>
</tr>
<tr>
<td>1994</td>
<td>Hadley Lake Benthic Stickleback</td>
<td><em>Gasterosteus</em> sp. 13</td>
<td>Hadley Lake on Lasqueti Island, British Columbia</td>
<td>fish</td>
</tr>
<tr>
<td>1994</td>
<td>Pearson's Hawthorn</td>
<td><em>Crataegus pearsonii</em></td>
<td>Mississippi, Louisiana and Texas</td>
<td>plant</td>
</tr>
<tr>
<td>1992</td>
<td>Vancouver Island Wolverine</td>
<td><em>Gulo gulo vancouerensis</em></td>
<td>Vancouver Island, British Columbia</td>
<td>mammal</td>
</tr>
<tr>
<td>1988</td>
<td>Fish Lake Pyrg</td>
<td><em>Pyrgulopsis ruinosa</em></td>
<td>One spring in Esmeralda County, Nevada</td>
<td>mollusc</td>
</tr>
<tr>
<td>1988</td>
<td>Maryland Darter</td>
<td><em>Etheostoma sellare</em></td>
<td>Streams near the head of Chesapeake Bay in Maryland</td>
<td>fish</td>
</tr>
<tr>
<td>1988</td>
<td>Bachman's Warbler</td>
<td><em>Vermivora bachmanii</em></td>
<td>Nested in Missouri, Arkansas, Kentucky, Alabama, South Carolina, and Louisiana; wintered in Cuba and Isle of Pines</td>
<td>bird</td>
</tr>
<tr>
<td>1987</td>
<td>Dusky Seaside Sparrow</td>
<td><em>Ammomanus maritimus nigrescens</em></td>
<td>East coast of Florida</td>
<td>bird</td>
</tr>
<tr>
<td>Year</td>
<td>Species Name</td>
<td>Scientific Name</td>
<td>Location</td>
<td>Count</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------</td>
<td>----------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-------</td>
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<tr>
<td>1986</td>
<td>Banff Longnose Dace</td>
<td><em>Rhinichthys cataractae smithi</em></td>
<td>A marsh fed by hot springs near Banff, Alberta</td>
<td>fish</td>
</tr>
<tr>
<td>1985</td>
<td>Shortnose Cisco</td>
<td><em>Coregonus reighardi</em></td>
<td>Lakes Huron, Michigan and Ontario</td>
<td>fish</td>
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<tr>
<td>1984</td>
<td>Green Blossom</td>
<td><em>Epioblasma torulosa gubernaculum</em></td>
<td>Tennessee and Virginia</td>
<td>mollusc</td>
</tr>
<tr>
<td>1983</td>
<td>San Marcos Gambusia</td>
<td><em>Gambusia georgei</em></td>
<td>San Marcos River, Texas</td>
<td>fish</td>
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<tr>
<td>1978</td>
<td>Kingman's Prickly-pear</td>
<td><em>Opuntia superbospina</em></td>
<td>Mojave Desert, Arizona</td>
<td>plant</td>
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<tr>
<td>late</td>
<td>Amistad Gambusia</td>
<td><em>Gambusia amistadensis</em></td>
<td>Goodenough Spring, Texas</td>
<td>fish</td>
</tr>
<tr>
<td>1975</td>
<td>Phantom Shiner</td>
<td><em>Notropis orca</em></td>
<td>Rio Grande River in New Mexico and Texas</td>
<td>fish</td>
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<tr>
<td>mid</td>
<td>Lewis's Woodpecker, Georgia Depression Population</td>
<td><em>Melanerpes lewis pop. 1</em></td>
<td>Southwestern British Columbia and western Washington state</td>
<td>bird</td>
</tr>
<tr>
<td>1974</td>
<td>Tacoma Pocket Gopher</td>
<td><em>Thomomys mazama tacomensis</em></td>
<td>Pierce County, Washington state</td>
<td>mammal</td>
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<tr>
<td>1973</td>
<td>Carinate Duckwater Pyrg</td>
<td><em>Pyrgulopsis carinata</em></td>
<td>Spring in Duckwater Valley, Nye County, Nevada</td>
<td>mollusc</td>
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<tr>
<td>1971</td>
<td>Santa Cruz Pupfish</td>
<td><em>Cyprinodon arcuatus</em></td>
<td>Monkey Spring in Arizona</td>
<td>fish</td>
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<tr>
<td>1971</td>
<td>Zion Jimmyweed</td>
<td><em>Isocoma humilis</em></td>
<td>Washington County, Utah</td>
<td>plant</td>
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<tr>
<td>Year</td>
<td>Species</td>
<td>Geographic Range</td>
<td>Category</td>
<td></td>
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<tr>
<td>--------</td>
<td>-------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
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<tr>
<td>1971</td>
<td>Blue Walleye</td>
<td>Lake Erie, Lake Ontario, lower Niagara River and Lake Huron</td>
<td>fish</td>
<td></td>
</tr>
<tr>
<td>1970s</td>
<td>Acornshell</td>
<td>Cumberland and Tennessee River systems in Alabama, Virginia, Tennessee and Kentucky</td>
<td>mollusc</td>
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<tr>
<td>1970</td>
<td>Clear Lake Splittail</td>
<td>Clear Lake, California</td>
<td>fish</td>
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<tr>
<td>1969</td>
<td>Blackfin Cisco</td>
<td>Lake Huron and Lake Michigan</td>
<td>fish</td>
<td></td>
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<tr>
<td>1969</td>
<td>Tubercled Blossom</td>
<td>Alabama, Illinois, Indiana, Kentucky, Ohio, Tennessee and West Virginia</td>
<td>mollusc</td>
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<tr>
<td>1968</td>
<td>Striped Bass, St. Lawrence Estuary population</td>
<td>Quebec</td>
<td>fish</td>
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<tr>
<td>1967</td>
<td>Angled Riffleshell</td>
<td>Alabama, Kentucky and Tennessee</td>
<td>mollusc</td>
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<tr>
<td>1967</td>
<td>Narrow Catspaw</td>
<td>Tennessee River system in Virginia, Tennessee and Alabama</td>
<td>mollusc</td>
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<tr>
<td>1967</td>
<td>Lined Pocketbook</td>
<td>Upper Chattahoochee and Flint River systems in Alabama and Georgia</td>
<td>mollusc</td>
<td></td>
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<tr>
<td>mid 1960s</td>
<td>Turgid Blossom</td>
<td>Alabama, Arkansas and Tennessee</td>
<td>mollusc</td>
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<tr>
<td>1964</td>
<td>Bluntnose Shiner</td>
<td>Rio Grande River in New Mexico and Texas</td>
<td>fish</td>
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<td>1964</td>
<td>Lake Ontario Kiyi</td>
<td>Ontario</td>
<td>fish</td>
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<td>1964</td>
<td>Bay Springs Salamander</td>
<td>Jasper County, Mississippi</td>
<td>amphibian</td>
<td></td>
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<td>1963</td>
<td>Eskimo Curlew</td>
<td>Nested in Northwest Territories, wintered in Argentina</td>
<td>bird</td>
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</tbody>
</table>
Biodiversity Hotspots?

- Two qualifying criteria
- Region must have 1500 endemic vascular plant species
- Region must have 30% or less of native vegetation
- Globally, 35 areas qualify as hotspots
- 2.3% of Earth’s land surface
- Support more than half of the world’s plant species as endemics
- 43% of bird, mammal, reptile and amphibian species as endemics
GLOBAL BIODIVERSITY: SPECIES NUMBERS OF VASCULAR PLANTS

Diversity Zones (DZ)  Number of species per 10,000km²

- DZ 1 (<100)
- DZ 2 100 - 200
- DZ 3 200 - 500
- DZ 4 500 - 1000
- DZ 5 1000 - 1500
- DZ 6 1500 - 2000
- DZ 7 2000 - 3000
- DZ 8 3000 - 4000
- DZ 9 4000 - 5000
- DZ 10 (>5000)

Cepensis  Tropic regions

Sea surface temperature
- >29°C
- >27°C

Cold currents

Robinson Projection
Standard Parallels 38°N and 38°S

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W. Bergholt, N. Biedinger, G. Braun, F. Feig, G. Kier
W. Lauer & J. Mulke 1999
modified after
W. Bergholt, W. Lauer & A. Plakter 1999
Department of Botany and Geography
University of Bonn
German Aerospace Research Establishment, Cologne
Cartography: M. Graf
Department of Geography University of Bonn
Ecoregions of North America

• 15 Level I Ecoregions

• 50 Level II Ecoregions

• 182 Level III Ecoregions
Level III Ecosystems

- COAST RANGE
- PUGET LOWLANDS
- WILAMETTE VALLEY
- CASCADES
- SIERRA NEVADA
- CENTRAL CALIFORNIA FOOTHILLS AND COASTAL MOUNTAINS
- CENTRAL CALIFORNIA VALLEY
- SOUTHERN CALIFORNIA MOUNTAINS
- EASTERN CASCADE SLOPES AND FOOTHILLS
- COLUMBIA PLATEAU
- BLUE MOUNTAINS
- SNAKE RIVER PLAIN
- CENTRAL BASIN AND RANGE
- MOJAVE BASIN AND RANGE
- NORTHERN ROCKIES
- IDAHO BATHOLITH
- MIDDLE ROCKIES
- WYOMING BASIN
- WASATCH AND UINTA MOUNTAINS
- COLORADO PLATEAUS
- SOUTHERN ROCKIES
- ARIZONA/NEW MEXICO PLATEAU
- ARIZONA/NEW MEXICO MOUNTAINS
- CHIHUAHUAN DESERTS
Level III Ecosystems (cont.)

- HIGH PLAINS
- SOUTHWESTERN TABLELANDS
- CENTRAL GREAT PLAINS
- FLINT HILLS
- CROSS TIMBERS
- EDWARDS PLATEAU
- SOUTHERN TEXAS PLAINS
- TEXAS BLACKLAND PRAIRIES
- EAST CENTRAL TEXAS PLAINS
- WESTERN GULF COASTAL PLAIN
- SOUTH CENTRAL PLAINS
- OUACHITA MOUNTAINS
- ARKANSAS VALLEY
- BOSTON MOUNTAINS
- OZARK HIGHLANDS
- CENTRAL IRREGULAR PLAINS
- CANADIAN ROCKIES
- NORTHEASTERN GLACIATED PLAINS
- NORTHEASTERN GREAT PLAINS
- NEBRASKA SANDHILLS
- PIEDMONT
- NORTHERN GLACIATED PLAINS
- WESTERN CORN BELT PLAINS
- LAKE AGASSIZ PLAIN
- NORTHERN MINNESOTA WETLANDS
- NORTHERN LAKES AND FORESTS
- NORTH CENTRAL HARDWOOD FORESTS
- DRIFTLESS AREA
Level III Ecosystems (cont.)

- SOUTHEASTERN WISCONSIN TILL PLAINS
- CENTRAL CORN BELT PLAINS
- EASTERN CORN BELT PLAINS
- SOUTHERN MICHIGAN/NORTHERN INDIANA DRIFT PLAINS
- HURON/ERIE LAKE PLAINS
- NORTHEASTERN HIGHLANDS
- NORTHEASTERN COASTAL ZONE
- NORTHERN ALLEGHENY PLATEAU
- ERIE DRIFT PLAIN
- NORTH CENTRAL APPALACHIANS
- MIDDLE ATLANTIC COASTAL PLAIN
- NORTHERN PIEDMONT
- SOUTHEASTERN PLAINS
- BLUE RIDGE
- RIDGE AND VALLEY
- SOUTHWESTERN APPALACHIANS
- CENTRAL APPALACHIANS
- WESTERN ALLEGHENY PLATEAU
- INTERIOR PLATEAU
- INTERIOR RIVER VALLEYS AND HILLS
- MISSISSIPPI ALLUVIAL PLAIN
- MISSISSIPPI VALLEY LOESS PLAINS
- SOUTHERN COASTAL PLAIN
- SOUTHERN FLORIDA COASTAL PLAIN
- NORTH CASCADES
- KLAMATH MOUNTAINS AND CALIFORNIA HIGH NORTH COAST RANGE
- MADREAN ARCHIPELAGO
Level III Ecosystems (cont.)

- NORTHERN BASIN AND RANGE
- SONORAN BASIN AND RANGE
- ACADIAN PLAINS AND HILLS
- EASTERN GREAT LAKES LOWLANDS
- ATLANTIC COASTAL PINE BARRENS
- SOUTHERN CALIFORNIA/NORTHERN BAJA COAST
- ARCTIC COASTAL PLAIN
- ARCTIC FOOTHILLS
- BROOKS RANGE
- INTERIOR FORESTED LOWLANDS AND UPLANDS
- INTERIOR HIGHLANDS
- INTERIOR BOTTOMLANDS
- YUKON FLATS
- OGILVIE MOUNTAINS
- SUBARCTIC COASTAL PLAINS
- SEWARD PENINSULA
- AHIKLUN AND KILBUCK MOUNTAINS
- BRISTOL BAY-NUSHAGAK LOWLANDS
- ALASKA PENINSULA MOUNTAINS
- ALEUTIAN ISLANDS
- COOK INLET
- ALASKA RANGE
- COPPER PLATEAU
- WRANGLELL MOUNTAINS
- PACIFIC COASTAL MOUNTAINS
- COASTAL WESTERN HEMLOCK-SITKA SPRUCE FORESTS
Biodiversity Hotspots Overlaid Urban Development
Global Maize Area
Global Rangeland & Pasture

Vegetation Cover Anomaly [%]
Difference between vegetation cover (*) in January 2016 and the mean vegetation cover for January in 2000-2015
* Vegetation cover includes the photosynthetic and non-photosynthetic fractions
gray areas are not rangeland/pastures or have no data
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Extent of Invasive Species
Kudzu (*Pueraria montana*)