Food supplies title:

**Where our food crops come from**

Food supplies summary:

Explore the links between where food crops come from – their native origins and traditional regions of diversity – and where they are now eaten worldwide. Hover over regions and flows to discover how much our food supplies are comprised of crops native to different regions of the world.

By:

Colin K. Khoury, Harold A. Achicanoy, Anne D. Bjorkman, Carlos Navarro-Racines, Luigi Guarino, Ximena Flores-Palacios, Johannes M. M. Engels, John H. Wiersema, Hannes Dempewolf, Steven Sotelo, Julian Ramírez-Villegas, Nora P. Castañeda-Álvarez, Cary Fowler, Andy Jarvis, Loren H. Rieseberg, and Paul C. Struik

Food supplies content:

These circular plots link the “primary regions of diversity” of crops (regions where crops were initially domesticated and evolved over long periods of time, and where the diversity of traditional crop varieties and related wild plants is especially high) with crops’ current importance in regional food supplies, measured in terms of calories (kcal/capita/day), protein (g/capita/day), fat (g/capita/day), and food weight (g/capita/day).

Each region has a color representing its own “native” crops and those colors are connected to other regions due the importance of those crops in the diets of other regions. The direction of the contribution is indicated by both the “native” region’s color and a gap between the connecting line and the consuming region’s segment. The magnitude of contribution is indicated by the width of the connecting line. Regional food supply values were formed by deriving a weighted average of national food supply values across countries comprising each region, with national values weighted by population.

For example, tropical South America is represented in crimson. The crimson lines represent the amount of regional food supplies derived from crops “native” to the region- such as cassava, groundnut, and cocoa beans- eaten in different regions of the world. In turn, tropical South America consumes crops “native” to other regions, for example, rice, sugarcane, and bananas and plantains.

N America (North America):

Includes Canada and United States of America.

Primary region of diversity of grapes and sunflower.

C America (Central America and Mexico):

Includes Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama.

Primary region of diversity of beans, cassava, cocoa beans, cottonseed oil, maize, palm oil, pimento, sweet potatoes, and yautia (roots other commodity).

Caribbean:

Includes Antigua and Barbuda, Bahamas, Barbados, Bermuda, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago.

Primary region of diversity of cottonseed oil, pimento, and yautia (roots other commodity).

Andes:

Includes Bolivia, Chile, Colombia, Ecuador, and Peru.

Primary region of diversity of beans, potatoes, and tomatoes.

Trop. S. America (Tropical South America):

Includes Bolivia, Brazil, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, and Venezuela.

Primary region of diversity of cassava, cocoa beans, cottonseed oil, groundnut, palm oil, pimento, pineapples, sweet potatoes, tea, yams, and yautia (roots other commodity).

Temp. S. America (Temperate South America):

Includes Argentina, Chile, and Uruguay.

Primary region of diversity of mate (tea commodity).

W Africa (West Africa):

Includes Benin, Burkina Faso, Cabo Verde, Chad, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo

Primary region of diversity of coffee, cowpeas (pulses other commodity), millets, palm oil, rice, sorghum, and yams.

C Africa (Central Africa):

Includes Angola, Cameroon, Central African Republic, Congo, Gabon, and Sao Tome and Principe.

Primary region of diversity of coffee, cowpeas (pulses other commodity), palm oil, rice, and sorghum.

E Africa (East Africa):

Includes Djibouti, Ethiopia, Kenya, Rwanda, Somalia, Sudan (former), and Uganda.

Primary region of diversity of coffee, cottonseed oil, cowpeas and bambara beans (pulses other commodity), millets, olives, peas, sesame, and sorghum.

S Africa (Southern Africa):

Includes Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, United Republic of Tanzania, Zambia, and Zimbabwe.

Primary region of diversity of cottonseed oil, cowpeas and bambara beans (pulses other commodity), millets, and sorghum.

IOI (Indian Ocean Islands)

Includes Madagascar and Mauritius.

NW Europe (Northwest Europe):

Includes Austria, Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Sweden, Switzerland, and United Kingdom.

Primary region of diversity of apples, oats, and sugar beet (sugar commodity).

SW Europe (Southwest Europe):

Includes France, Italy, Portugal, and Spain.

Primary region of diversity of apples, olives, peas, rape & mustard, and sugar beet (sugar commodity).

NE Europe (Northeast Europe):

Includes Belarus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Republic of Moldova, Romania, Russian Federation, Slovakia, and Ukraine.

Primary region of diversity of apples, oats, and sugar beet (sugar commodity).

SE Europe (Southeast Europe):

Includes Albania, Armenia, Bosnia and Herzegovina, Bulgaria, Croatia, Georgia, Greece, Montenegro, Serbia, Slovenia, The former Yugoslav Republic of Macedonia, and Turkey.

Primary region of diversity of apples, olives, peas, rape & mustard, and sugar beet (sugar commodity).

SE Mediterranean (South and East Mediterranean):

Includes Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Libya, Malta, Morocco, Occupied Palestinian Territory, Syrian Arab Republic, Tunisia, and Turkey.

Primary region of diversity of barley; chickpeas, lentils and lupins (pulses other commodity); dates; grapes; olives; peas, rape & mustard; sugar beet (sugar commodity); and wheat.

W Asia (West Asia):

Includes Afghanistan, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kuwait, Lebanon, Occupied Palestinian Territory, Pakistan, Saudi Arabia, Syrian Arab Republic, Turkey, United Arab Emirates, and Yemen.

Primary region of diversity of barley; chickpeas, faba beans and lentils (pulses other commodity); dates; grapes; olives; onions; peas; rye; sesame and wheat.

C Asia (Central Asia):

Includes Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan.

Primary region of diversity of apples, barley, onions, and wheat.

S Asia (South Asia):

Includes Bangladesh, India, Maldives, Nepal, and Sri Lanka.

Primary region of diversity of bananas & plantains; chickpeas, lentils and pigeonpeas (pulses other commodity); coconuts; dates; lemons & limes; millets; pepper; rice; sesame; sugarcane sugar commodity); taro (roots other commodity); tea; and yams.

E Asia (East Asia):

Includes China (mainland), Democratic People's Republic of Korea, Hong Kong SAR, Japan, Macao SAR, Mongolia, Republic of Korea, and Taiwan.

Primary region of diversity of apples, grapefruit, grapes, lemons & limes, millets, oranges & mandarines, rice, soybean, and tea.

SE Asia (Southeast Asia):

Includes Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Thailand, Timor-Leste, and Viet Nam.

Primary region of diversity of bananas & plantains, cloves, coconuts, grapefruit, millets, rice, sugarcane (sugar commodity), taro (roots other commodity), tea, and yams.

Pacific (Tropical Pacific Region):

Includes Fiji, French Polynesia, Kiribati, New Caledonia, Samoa, Solomon Islands, and Vanuatu.

Primary region of diversity of coconuts and taro (roots other commodity).

ANZ (Australia and New Zealand):

Includes Australia and New Zealand.

Production title:

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Production summary:

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Production content:

These circular plots link the “primary regions of diversity” of crops (regions where crops were initially domesticated and evolved over long periods of time, and where the diversity of traditional crop varieties and related wild plants is especially high) with crops’ current importance in regional agricultural production, measured in terms of total production quantity (tonnes), harvested area (ha), and gross production value (million US$)]. Each region has a color representing its own “native” crops and those colors are connected to other regions due the production of those crops in other regions. The direction of the contribution is indicated by both the “native” region’s color and a gap between the connecting line and the producing region’s segment. The magnitude of contribution is indicated by the width of the connecting line. Regional production values were formed by summing national production values across countries comprising each region.

For example, tropical South America is represented in crimson. The crimson lines represent the amount of production derived from crops “native” to the region- such as cassava, groundnut, and cocoa beans- that are produced in different regions of the world. In turn, tropical South America produces crops “native” to other regions, for example, rice, sugarcane, and bananas and plantains.

N America (North America):

Includes Canada and United States of America.

Primary region of diversity of blueberries, cranberries, grapes, pumpkins & gourds, raspberries, strawberries, and sunflower.

C America (Central America and Mexico):

Includes Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama.

Primary region of diversity of avocados, beans, cassava, chillies & peppers, cocoa beans, cottonseed oil, guavas (mangoes mangosteens guavas commodity), maize, palm oil, papayas, pumpkins & gourds, sweet potatoes, vanilla, and yautia.

Caribbean:

Includes Antigua and Barbuda, Bahamas, Barbados, Bermuda, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago.

Primary region of diversity of chillies & peppers, cottonseed oil, vanilla, and yautia.

Andes:

Includes Bolivia, Chile, Colombia, Ecuador, and Peru.

Primary region of diversity of beans, lupins, potatoes, quinoa, and tomatoes.

Trop. S. America (Tropical South America):

Includes Bolivia, Brazil, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, and Venezuela.

Primary region of diversity of brazil nuts, cashew, cassava, chillies & peppers, cocoa beans, cottonseed oil, groundnut, guavas (mangoes mangosteens guavas commodity), mate, palm oil, papayas, pineapples, pumpkins & gourds, sweet potatoes, vanilla, yams, and yautia.

Temp. S. America (Temperate South America):

Includes Argentina, Chile, and Uruguay.

Primary region of diversity of mate, quinoa, and strawberries.

W Africa (West Africa):

Includes Benin, Burkina Faso, Cabo Verde, Chad, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo.

Primary region of diversity of coffee, cowpeas, fonio, kola nuts, melons, millets, palm oil, rice, sheanuts, sorghum, and yams.

C Africa (Central Africa):

Includes Angola, Cameroon, Central African Republic, Congo, Gabon, and Sao Tome and Principe.

Primary region of diversity of coffee, cowpeas, kola nuts, palm oil, rice, sheanuts, and sorghum.

E Africa (East Africa):

Includes Djibouti, Ethiopia, Kenya, Rwanda, Somalia, Sudan (former), and Uganda.

Primary region of diversity of bambara beans, castor oil, coffee, cottonseed oil, cowpeas, melons, millets, olives, peas, peppermint, sesame, sheanuts, and sorghum.

S Africa (Southern Africa):

Includes Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, United Republic of Tanzania, Zambia, and Zimbabwe.

Primary region of diversity of bambara beans, cottonseed oil, cowpeas, melons, millets, peppermint, pumpkins & gourds, sorghum, and watermelons.

IOI (Indian Ocean Islands):

Includes Madagascar and Mauritius.

NW Europe (Northwest Europe):

Includes Austria, Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Sweden, Switzerland, and United Kingdom.

Primary region of diversity of apples, asparagus, sugar beet, chicory roots, clover, currants, gooseberries, hazelnuts, hops, lettuce, linseed, oats, peppermint, and raspberries.

SW Europe (Southwest Europe):

Includes France, Italy, Portugal, and Spain.

Primary region of diversity of anise, coriander and fennel (anise badian fennel coriander commodity), apples, artichokes, asparagus, sugar beet, cabbages, carob, carrots & turnips, chicory roots, clover, currants, figs, gooseberries, hazelnuts, hops, leeks, lettuce, linseed, lupins, mustard seed, olives, peas, peppermint, poppy, rapeseed, raspberries, and vetches.

NE Europe (Northeast Europe):

Includes Belarus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Republic of Moldova, Romania, Russian Federation, Slovakia, and Ukraine.

Primary region of diversity of apples, asparagus, sugar beet, chicory roots, clover, currants, gooseberries, hazelnuts, hops, lettuce, linseed, oats, peppermint, and raspberries.

SE Europe (Southeast Europe):

Includes Albania, Armenia, Bosnia and Herzegovina, Bulgaria, Croatia, Georgia, Greece, Montenegro, Serbia, Slovenia, The former Yugoslav Republic of Macedonia, and Turkey.

Primary region of diversity of anise, coriander and fennel (anise badian fennel coriander commodity), apples, artichokes, asparagus, sugar beet, cabbages, carob, carrots & turnips, cherries, chestnut, chicory roots, clover, currants, gooseberries, hazelnuts, hops, leeks, lettuce, linseed, lupins, mustard seed, olives, pears, peas, peppermint, plums, poppy, rapeseed, raspberries, safflower seed, vetches, and walnuts.

SE Mediterranean (South and East Mediterranean):

Includes Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Libya, Malta, Morocco, Occupied Palestinian Territory, Syrian Arab Republic, Tunisia, and Turkey.

Primary region of diversity of anise, coriander and fennel (anise badian fennel coriander commodity), artichokes, asparagus, barley, sugar beet, cabbages, carob, carrots & turnips, castor oil, chestnut, chickpeas, chicory roots, clover, dates, figs, gooseberries, grapes, hops, leeks, lentils, lettuce, linseed, lupins, mustard seed, olives, peas, peppermint, poppy, rapeseed, raspberries, triticale, and wheat.

W Asia (West Asia):

Includes Afghanistan, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kuwait, Lebanon, Occupied Palestinian Territory, Pakistan, Saudi Arabia, Syrian Arab Republic, Turkey, United Arab Emirates, and Yemen.

Primary region of diversity of alfalfa, almonds, anise and coriander (anise badian fennel coriander commodity), asparagus, barley, carrots & turnips, castor oil, cherries, chestnut, chickpeas, chicory roots, clover, dates, faba beans, figs, gooseberries, grapes, hazelnuts, hempseed, hops, leeks, lentils, lettuce, linseed, melons, olives, onions, pears, peas, peppermint, pistachios, plums, quinces, raspberries, rye, safflower seed, sesame, spinach, triticale, walnuts, and wheat.

C Asia (Central Asia):

Includes Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan.

Primary region of diversity of alfalfa, almonds, apples, apricots, asparagus, barley, carrots & turnips, cherries, chestnut, chicory roots, clover, currants, figs, garlic, gooseberries, hazelnuts, hempseed, hops, leeks, lettuce, linseed, onions, peppermint, pistachios, quinces, raspberries, safflower seed, spinach, triticale, walnuts, and wheat.

S Asia (South Asia):

Includes Bangladesh, India, Maldives, Nepal, and Sri Lanka.

Primary region of diversity of areca nuts, bananas & plantains, cardamoms (nutmeg mace cardamoms commodity), castor oil, chickpeas, chicory roots, cinnamon, clover, coconuts, cucumbers, dates, eggplants, figs, ginger, hempseed, lemons & limes, lentils, mangoes (mangoes mangosteens guavas commodity), melons, millets, okra, pepper, pigeonpeas, rice, sesame, sugarcane, taro, tea, walnuts, and yams.

E Asia (East Asia):

Includes China (mainland), Democratic People's Republic of Korea, Hong Kong SAR, Japan, Macao SAR, Mongolia, Republic of Korea, and Taiwan.

Primary region of diversity of apples, apricots, badian (anise badian fennel coriander commodity), buckwheat, cabbages, cinnamon, cucumbers, eggplants, grapefruit, grapes, hops, kiwi, lemons & limes, melons, millets, oranges, peaches & nectarines, pears, persimmons, plums, raspberries, rice, soybean, tangerines & mandarins, and tea.

SE Asia (Southeast Asia):

Includes Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Thailand, Timor-Leste, and Viet Nam.

Primary region of diversity of badian (anise badian fennel coriander commodity), areca nuts, bananas & plantains, cinnamon, cloves, coconuts, cucumbers, eggplants, grapefruit, mangoes and mangosteens (mangoes mangosteens guavas commodity), melons, millets, nutmeg and mace (nutmeg mace cardamoms commodity), okra, pears, plums, rice, sugarcane, taro, tea, and yams.

Pacific (Tropical Pacific Region):

Includes Fiji, French Polynesia, Kiribati, New Caledonia, Samoa, Solomon Islands, and Vanuatu.

Primary region of diversity of coconuts, melons, and taro.

ANZ (Australia and New Zealand):

Includes Australia and New Zealand.

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About the data:

We analyzed the full set of food crop commodities included in national food supply and pertinent national production data provided by FAO (2014) [for food supplies- calories (kcal/capita/day), protein (g/capita/day), fat (g/capita/day), and food weight (g/capita/day); for production systems- production quantity (tonnes), harvested area (ha), and gross production value (million US$)]. National food supply from plants represents national production plus imports plus or minus stock changes over the survey period; minus exports, quantities used for seed, animal feed, and in the manufacture of non-food products, and losses during storage and transport. While food supplies data accounts for direct human consumption, production data for crops such as maize and soybean is potentially inclusive of livestock and industrial uses as well as human food. In the production analysis we also included agricultural crops indirectly contributing to human food supplies via livestock production (i.e., alfalfa, clover, and vetch). Non-food (e.g., industrial and fibre) crops as well as animal product commodities were not included in the analysis. Plant commodities comprised of the same crop species were aggregated into single commodities representing the crop, e.g., sesame seed oil and sesame seed. After aggregation, 53 crop commodities remained in food supplies data, and 132 crop commodities in production data.

We analyzed data for each crop commodity per country per measurement over the most recent three years for which sufficient data were available (2009-2011). All (177) countries consistently reported during the time period were included for food supplies variables, as well as for production quantity and harvested area, covering 98.5% of the world’s population. All (141) countries reported for (current million US$) production value were included, covering 94.1% of the world’s population.

Primary regions of diversity were assigned based upon primary and secondary literature regarding centres of crop diversity, origins of crop domestication, and high species richness of closely related wild plants. Regional classifications followed those listed in Annex 2 of the FAO State of the World’s Plant Genetic Resources for Food and Agriculture (2010), modified to more accurately represent eco-geographic parameters driving plant species distributions. Specifically, both western and eastern Europe were split into north and south regions to account for temperate versus Mediterranean ecologies; Australia and New Zealand were segregated from remaining (tropical) islands of the Pacific region; and South America was split into Andean, temperate, and tropical regions. A total of 23 eco-geographic regions were delineated worldwide. In order to account for eco-geographic variation within countries, countries whose boundaries included more than one eco-geographic region were included in all appropriate regions (e.g., Colombia was assigned both to Andean and to tropical South American regions).

To be generally inclusive in regard to regions of diversity of crops, crops whose primary areas of diversity encompassed more than one eco-geographic region were listed in all appropriate regions (e.g., wheat was listed in Central Asia, West Asia, and the South and East Mediterranean due to the high diversity of traditional crop varieties and wild relatives in each of these regions). Forty-two of the 53 crop commodities treated in food supplies data, and 116 of the 132 crops in production data, were attributable to primary regions of diversity, with the remaining general commodities which were not clearly attributable to specific crop species listed as “not specified”. These not specified commodities included - (for food supplies) - beverages, alcoholic, beverages, fermented, cereals, other, citrus, other, fruits, other, miscellaneous, oilcrops, other, spices, other, sweeteners, other, treenuts, and vegetables, other; (for production systems) - berries nes, cereals nes, fruit citrus nes, fruit fresh nes, fruit pome nes, fruit stone nes, fruit tropical fresh nes, grain mixed, nuts nes, oilseeds nes, pulses nes, roots tubers nes, spices nes, tea nes, vegetables fresh nes, and vegetables leguminous nes.

About the plot:

These circular plots, adapted from Abel and Sander (2014), link the “primary regions of diversity” of crops (regions where crops were initially domesticated and evolved over long periods of time, and where the diversity of traditional crop varieties and related wild plants is especially high) with crops’ current importance in regional food supplies, measured in terms of calories (kcal/capita/day), protein (g/capita/day), fat (g/capita/day), and food weight (g/capita/day).

Each region has a color representing its own “native” crops and those colors are connected to other regions due the importance of those crops in the diets of other regions. The direction of the contribution is indicated by both the “native” region’s color and a gap between the connecting line and the consuming region’s segment. The magnitude of contribution is indicated by the width of the connecting line. Regional food supply values were formed by deriving a weighted average of national food supply values across countries comprising each region, with national values weighted by population.

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