

Agricultural Transition Year  
Country Data Set

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*Introduction*

It has been hypothesized that differences among human societies in the time at which the transition from reliance upon hunting and gathering to reliance upon agriculture took place led to differences in levels of technological development and social organization that persisted into the era of European expansion beginning in the 15<sup>th</sup> century (e.g., Diamond, 1998), helping to explain why many non-European societies were colonized by European ones. Such differences are also hypothesized to persist to the present day (Hibbs and Olsson, 2004, 2005; Chanda and Putterman, 2006). To test the hypothesis that early agricultural development is associated with higher income today, Hibbs and Olsson assembled data on the biogeographic and geographic variables suggested by Diamond and the estimated dates of transition to agriculture in a few areas, showed that biogeography and geography could predict the dates of transition, and used the predicted dates of transition for six macro-regions to predict incomes in 112 countries in 1997. A limitation of the data available to Hibbs and Olsson is that the same date of transition of a given region is assigned to a very large number of countries, which is justifiable only if we assume that what matters is when the agricultural tradition that a country's farmers draw upon first started, rather than when people in that country transitioned to agriculture. For example, the estimate for Mesopotamia is used not only for present-day Iraq and Turkey but also for all of Europe, Canada, the U.S., Australia and New Zealand.

We investigated whether estimates of the date of agriculture were available on a more location-specific basis. When we were unable to identify any existing compilation of data meeting our objectives, we undertook to assemble such data from the best sources presently available. The research was done during 2004 – 2006 under the supervision of Brown University Professor of Economics Louis Putterman by three bachelors degree candidates, Arthur Hintermeister, Rahim Kassam-Adams, and Cary Anne Trainor. Trainor did the largest part of the research, including checking estimates for cross-country consistency and writing up most of the notes that follow, which provide background on sources and the rationale for the less obvious choices.

Our project was undertaken with the narrow goal of assembling what appear to be current consensus estimates. No member of the team that assembled these data is an expert on the archeology of agricultural transition; we relied on the sources that we list below, and where necessary on our judgment. We look forward to the time when our data can be replaced by a still more reliable compilation.

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We have sought to identify a time of transition for as many of today's countries as possible. We use today's countries as observational units even though they often bear little relationship to the relevant social geography at the time agriculture began, because our ultimate interest lies in studying possible impacts of early agricultural development on recent economic and other outcomes using an international sample of country-level observations. The nature of the units raises the question: how much of what is today country X must have been dependent on agriculture before we say that X achieved its agricultural transition? If only one river valley in what is now a much larger country had its agricultural transition at date  $t$ , should we then say that the country transitioned to agriculture at  $t$ ? Our answer, for the most part, is yes. Because we judged it to be too difficult to attempt to record the *spread* of agriculture over time *within* what is now a country, we decided to treat the transition in a simple "either/or" fashion and to treat a country as having made the agricultural transition as long as any appreciable region within the country had done so. For example, Turkey is counted as having made the transition quite early since a substantial portion of what is now Turkey, although by no means all of it, lies within the ancient "fertile crescent." India as a whole is considered as having made the transition once Indus Valley agriculture is well evident, even though this leaves large portions of modern India outside the sphere of agriculture for many centuries. The only exception to this procedure are a few cases in which agriculture developed in what is now a neighboring country and spread into a very small area across the border without showing any sign of spreading more generally until a much later date.

To establish a year of transition, we look for expert judgments that the people of an area were getting more than half of their calories from cultivated foods and domesticated animals. Although animal husbandry usually accompanies cultivation, there are some cases of animal herding without indications of cultivation, e.g. in Africa, and we do not consider a society that herds but does not plant to have made the agricultural transition. Once we decide upon a transition year on the basis of as many sources as possible, we enter in the accompanying spreadsheet the number of years before the present, or more precisely, before 2000 C.E. (A.D.), at which the transition is estimated to have taken place. So the data entries are to be read as "years b.p."

There are some countries for which little archaeological evidence appears to be available, but where the agreed pattern of diffusion within a region makes it possible to hazard a guess by means of interpolation. For such cases, we estimated the date of transition based on evidence from neighboring countries and evidence about the flow and spread of farming within the region.

Due to limited resources, we did not attempt to find estimates for most of the world's smaller countries, those with less than ½ million inhabitants today.

The remainder of this guide to the data set consists of notes on our research and sources by region and sub-region.

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## AFRICA

Many sources state that in Africa, unlike many other regions of the world, domestication of plants was non-centric: crops did not spread from a single geographic point of origin. Domesticated animals were present several thousand years before domesticated plants; the earliest food producers were mobile cattle herders. Archaeologists assert that concerns about the predictable availability of resources in arid environments, rather than increased yield, accelerated domestication in Africa (Harlan). The oldest regions of food production in Africa are the Sahel region, southern West Africa, Ethiopia, the Bantu farming zones, Egypt, and Madagascar.

### The Sahel (Senegal, Gambia, Guinea Bissau, Mauritania, Western Sahara, Mali, Burkina Faso, Niger)

Cowan and Watson write that pearl millet and sorghum predominated the thorn bush savanna of the Sahel because of its resistance to drought. The crops were widely distributed from west to east across the Sahel (Shaw *et al.*, 1993, p. 57; Diamond, 1998, p. 388). Shaw writes that domesticated pearl millet was recovered from Tichitt in south-central Mauritania, dating between 3000 and 2900 BP, but argues that cultivation probably preceded this date. Other archaeologists place the date slightly earlier. Harlan (1976) cites the Tichitt site as well as the Oualata site in Mauritania at 3500 BP. Smith (1995) cites the date for agriculture at 3500 BP. We place the Mauritania date at 3500 BP, with Senegal and neighboring Gambia and Guinea Bissau slightly later, at 3000 BP. Moving eastward across the Sahel, domestic pearl millet and sorghum were found at the site of Jenné Jenno in central Mali around 2000 BP (Smith, 1995, p. 108 and Harlan, 1995, p. 27). Both theorists argue that the first date for agriculture was probably earlier due to the spread of grain from Mauritania. We place the date for Mali at 3000 BP. Evidence of domestication in Burkina Faso was found at the Ti-n-Akof site dating to 2900 BP (Marshall and Hildebrand, 20002, p. 126).

In addition to early sites in Mauritania, other evidence for agriculture in the Sahel was found at Adrar Bous in the Ténéré Desert in Niger. Sorghum remains from the area were found at 4000 BP (Shaw *et al.*, 1993, p. 237). Smith summarizes: at Adrar Bous, “cattle were being herded by 5000 BP, and the cultivation of sorghum seems to have begun by 4000 years ago” (1995, p. 110).

### West Africa (Guinea, Sierra Leone, Liberia, Cote D’Ivoire, Ghana, Togo, Benin, Nigeria)

West Africa is widely regarded as a center for African agricultural origins, with most evidence from Ghana and Nigeria. Although some archaeologists postulate that food production in Ghana was practiced around 4000 BP (Shaw *et al.*, 1993, p. 255), tef and sorghum remains have been dated to slightly later. Cowan and Watson (1992) report pearl millet from the Ntereso site in northern Ghana dated to 3250 BP, while Marshall and Hildebrand (2002, p. 126) report it at 3460 BP at the Birimi site. We place the transition in Ghana at 3500 BP and assign that date also to neighboring Cote D’Ivoire. Remains suggest that grain-based agriculture was developed in the western part of the region and then moved eastward; however, no successful excavations were documented in Guinea, Sierra Leone, or Liberia. We place the dates for these countries at 3250 BP since they are situated between the western Sahel (with evidence dating to 3000 BP) and countries such as Ghana (with evidence dating to 3500 BP). Further, our sources suggest that food production in these countries originated not from the Sahelian but from the more southerly West African center of agricultural origin.

Moving eastward, domesticated pearl millet was found at 2930 and 2430 BP at the Gajiganna and Kursakata sites of the Chad basin of northeast Nigeria, respectively (Harlan, 1976, p. 24). We take the average of these dates, 2700 BP, and assign it to Nigeria and Chad. Given that Togo and Benin are located between Ghana and Nigeria, we place both countries at 3100 BP.

#### Ethiopia, Eritrea, Djibouti, Uganda, Kenya, Somalia

Ethiopia is widely regarded as an African center of origin of grain cultivation (Shaw *et al.* 1993, p. 19; Cowan and Watson, 1992; Diamond, 1998, p. 390). These theorists propose that Nilo-Saharan speaking farmers were forced out of eastern Sudan between 5000 and 4000 BP as the climate of the region became drier. They migrated east, introducing the cultivation of wheat and barley into Ethiopia by 4000 BP. We place the date for neighboring Eritrea and Djibouti at 4000 BP. Agriculture based on sorghum and millet moved southward into Uganda and Kenya, which Diamond places at 3500 BP (p. 394). We assign the 3500 BP date to Somalia as well.

#### Bantu Expansion (Democratic Republic of Congo, Rwanda, Burundi, Tanzania, Malawi, Mozambique, Botswana, South Africa, Zambia, Zimbabwe, Swaziland, Lesotho, Cameroon, Equatorial Guinea, Republic of Congo, Gabon, Angola, Namibia, Central African Republic, Botswana, South Africa)

Bantu farmers migrating from modern-day Cameroon began growing millet and sorghum around 3000 BP as they encountered Nilo-Saharan farmers in the Great Lakes region, reaching East Africa by 2000 BP (Diamond, 1998, p. 394; Shaw *et al.*, 1993, p. 19). We place the date for the Democratic Republic of Congo at 3000 BP and Rwanda, Burundi, and Tanzania at 2500 to reflect this pattern of eastward migration. The Bantu continued south, through modern-day Malawi, Zambia, Mozambique, Zimbabwe, Botswana and South Africa. Millet has been dated to the Early Iron Age in a handful of southern African sites: 1800 BP in Malawi (Shaw *et al.*, 1993, p. 19), 1400 BP in Mozambique (Shaw *et al.*, p. 421), 1000 BP in Botswana (Shaw *et al.*, p. 19), and 1700 BP in South Africa (Harlan, 1976, p. 21). Given these dates, we place Zambia (like Malawi) at 1800 BP, Zimbabwe (like Mozambique) at 1400 BP, and Swaziland and Lesotho (like South Africa) at 1500 BP.

Another group of Bantu traveled directly south from Cameroon, through Congo, Gabon, Angola, and into Namibia. Due to the lack of excavations in these areas, it is unclear when farming was introduced. We place the date for the Central African Republic at 3000 BP because that is the date for neighboring Nigeria. We can estimate the transition in Equatorial Guinea, Gabon, and Congo at 3000 BP since all the countries east and north of them had agriculture by this time. Further southward, Namibia borders Botswana (1000 BP) and South Africa (1500 BP), and developed grain-based agriculture after these countries did. We place the transition date for both Namibia and Angola at 1250 BP.

#### Egypt

Archaeological evidence for barley, emmer, and flax in the Fayum region of Egypt date to 7200 BP with millet appearing slightly later (Shaw *et al.*, 1993, p. 55, p. 199, p. 203; Cowan and Watson, 1992). This agriculture originated in the Fertile Crescent and spread southward into the Sudan around 5000 BP as evidenced at the Kadero 1, Um Direiwa, and Zakiab sites and westward into Libya by 5500 BP (Marshall and Hildebrand, 2002, p. 118; Ehret, 2002, p. 25; Shaw *et al.*, p. 18; Harlan, 1976). Little evidence is available on Algeria, Morocco, and Tunisia.

Since Sahelian agriculture spread southward, grain-based farming in these areas likely spread from Libya westward, between 5500 BP and 3000 BP, when it reached the western African coast. We place Tunisia at 4500 BP, Algeria at 4000 BP, and Morocco at 3500 BP.

### Madagascar

Although some have speculated that settlers traveled from the east African coast to Madagascar, linguistic evidence establishes that the first settlements in Madagascar resulted from migrations to the island from Indonesia or environs, which Campbell places at 2000 BP (1996, p. 873). Diamond includes their movement as part of the Austronesian expansion, noting that the migrants brought their crops and livestock with them. Migrants from the African mainland came later.

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## THE AMERICAS

### Central America (Mexico, Belize, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama)

Evan and Webster (2001) write that staple Mesoamerican cultigens such as maize and beans were first domesticated not in the Maya region but rather in the temperate or subtropical highlands of Mexico to the north and west. Evidence of prehistoric Mayan farming has been found primarily in the lowland tropics of Belize, the Guatemalan Petén, and Chiapas, Mexico. There is great debate over the beginning of reliance upon farming for calories: Diamond (1998, p. 142) contends that agricultural settlements did not appear in Mexico until 3500 BP, although he acknowledges that there is great uncertainty about this date. MacNeish (1992) says the first village was settled at 4800 BP, Smith (1995) provides a range from 4300 BP to 3500 BP, Piperno and Pearsall (1998) cite 4000 BP, Evan and Webster cite 4000 BP, and Bender (1975) cites 3900 BP. We average these dates at 4100 BP.

Crop cultivation spread southward from Mexico; Evans and Webster (p. 162) estimate the Cobweb Swamp region of Belize at 3500 BP and Piperno and Pearsall (p. 286) put the Maya settlement at Cuello in northern Belize at 3100 BP. We place the date at 3300 BP. In the highlands of Guatemala, the origins of village life are evident by 3500 BP (Evans and Webster, p. 308). The site Yojoa in western Honduras showed evidence of farming by 3000 BP, while sites in northeastern Honduras show “indications of increasing cultural and political complexity” by 3000 BP (Evan and Webster, p. 678). There is little evidence for El Salvador and Nicaragua; as a result we assign them 3000 BP, the same date as Honduras. The Chaparron and La Montana sites on the Atlantic watershed of Costa Rica cited by Piperno and Pearsall are dated to 2500 BP. Piperno in Stahl (2004, p. 138) state that “at 2400 BP the first signs of sedentary agricultural villages are evident” in central Panama.

### Northern South America (Peru, Ecuador, Colombia, Venezuela, Guyana, Suriname, French Guiana, Brazil)

There are three main hypotheses about the spread of agriculture into Ecuador and Peru outlined by Lavallée (2000, p. 137). The first is that agriculture originated in Mexico and spread southward into the Andes; however, this theory has been challenged by vast evidence of early and concurrent farming in Peru. The second is that the tropical lowlands were their own center of domestication. The third, and by far the most cited, is that the inter-Andean basin was a primary center of domestication and then diffusion of agriculture, independent of the Mexican center. Sites such as the Guitarrero Cave in Peru suggest that maize agriculture had begun there by 4300 BP (Bruhns, 1994, p. 79).

The northward spread of agriculture from Peru led to settlements in Ecuador and Colombia, while another center in Venezuela spread east. At the Lake Ayauch site at the base of the Andes in the southeastern Ecuadorian Amazon, forests were being cleared for maize by 5300 BP. Fiedel writes that “maize had probably been brought to the coast of Ecuador by 4500 BP” (1992, p. 186). A number of other Valdivia sites in Ecuador (Loma Alta, Real Alto, Las Vegas, San Isidro) point to settlements around 4000 BP; as a result, we set the date for Ecuador at 4000 BP. Pearsall (1998, p. 138) estimates the first intensive agricultural settlements in Colombia at 3800 BP, while Bruhns (1994, p. 68) places the date later, at 3000 BP. We average these dates at 3400 BP.

Piperno and Pearsall write that “it appears that an intensive form of agriculture based on bitter manioc spread rapidly from its hearth, probably located somewhere in the southern Venezuelan and Guianan regions, north to the tip of South America and south to east Brazil by approximately 4000-3600 BP” (1998, p. 286; see also Fiedel, 1992, p. 201). The Rancho Peludo site in western Venezuela shows evidence of manioc-based agriculture at 3800 BP. We assign Suriname and French Guiana transition dates of 3600 BP. Evidence for cultivation in Brazil is reported at 3500 BP, slightly later than Piperno and Pearsall suggest, so we assign Brazil this date.

#### Andean South America (Bolivia, Chile, Argentina, Paraguay, Uruguay)

Far fewer excavations have taken place south of Peru than north. However, Fiedel writes that sites in Chile show evidence of agriculture at 4000 BP, with Argentina slightly later, at 3800 BP (186). We assign Bolivia and Paraguay the same date as Chile, 4000 BP. Uruguay was traditionally thought to be outside the limits of prehistoric agriculture, but a settlement at Los Ajos in southeastern Uruguay suggests that farming took place there by at least 3600 BP (Stahl, 2004, p. 561).

#### Caribbean (Puerto Rico, Dominican Republic, Haiti, Trinidad and Tobago, Granada, Barbados, Jamaica, Bahamas, Cuba)

The prevailing theory for the spread of agriculture to the Caribbean is that it originated in Venezuela. Kiple and Ornelas summarize: “peoples expanded from northeastern Venezuela and the coast of the Guianas through the Lesser Antilles and Puerto Rico to establish a frontier in eastern Hispaniola (1270). Wilson confirms this theory, stating that these Saladoid people left South America at 2000 BP, bringing Venezuelan plants to the Caribbean islands, including manioc root, their staple crop. They established settlements in Puerto Rico as well as the eastern tip of Hispaniola, the modern-day Dominican Republic (Wilson 54, Ramcharan 17). The Saladoid reached Trinidad and Tobago and Granada at 2000 BP, Barbados at 1700 BP, and Puerto Rico and the eastern Dominican Republic at 1500 BP. The Taíno people followed the Saladoid, establishing settlements with manioc agriculture in Haiti and Jamaica around 1000 BP, and in the Bahamas and Cuba around 800 BP (Delpuech 161, Keegan 19).

#### North America (USA, Canada)

Although there is evidence of squash and gourd farming in the eastern United States by 3500 BP, the earliest grain-based agriculture took place in the southwest, having spread from Mexico. Gebauer and Price point to 3500 BP as the first concrete evidence of an agricultural village based on maize in the SW USA (215). Smith does not believe maize agriculture spread to the US until 3200 BP (155). Hurt places the date at 3300 BP (16) while Fagan states that maize, beans, and squash had been cultivated in northern Mexico for at least a thousand years before they spread into the southwest (257). We place the date at 3200 BP. Warrick places the date for the first corn-growing culture of the Saugeen in Ontario, Canada at 1500 BP.

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## EAST AND SOUTHEAST ASIA AND OCEANIA

Murphey (1996, p. 13) writes that mainland Southeast Asia received a series of migrants from the north over a long period who became almost the sole inhabitants of Burma (Myanmar), Thailand, Vietnam, Laos, and Cambodia, all of whom speak languages related to Chinese and Tibetan but unrelated to the languages of India. We will describe the flow of farming from China southward (China, Taiwan, Hong Kong, Myanmar (Burma), Bhutan, Bangladesh, Vietnam, Laos, Thailand, Cambodia, Malaysia, Brunei, Philippines, Singapore, Indonesia) and northward (Mongolia, Korea, Japan) and will then discuss the outlying countries (Australia, New Guinea, New Zealand, Mariana Islands).

### China, Taiwan, Hong Kong, Myanmar (Burma), Bhutan, Bangladesh, Vietnam, Laos, Thailand, Cambodia, Malaysia, Brunei, Philippines, Singapore, Indonesia, Fiji

Glover and Bellwood (2004, p. 23) write that “the first development of agriculture with morphologically domesticated cereals occurred in the Middle East about 10,500 BP, followed closely by China by about 9000 BP.” According to Wenke (1999, p. 518), the Middle Yangtze River Valley was the earliest to farm, with the Cishan, Peiligang, and Dadiwan cultures represented at a number of sites. He writes that “the earliest agricultural sites in South China are only a bit later than those in the north but our knowledge of them is much less advanced.” Foxtail and broomcorn millet and rice were the main crops at these sites. The Dapenkeng culture of Taiwan with evidence of rice cultivation is dated to 5500 BP (Bellwood 134, Glover and Bellwood 30); these archaeologists place Hong Kong at 5000 BP.

Moving southward, Bhutan and Bangladesh have evidence of cultivation at 5500 BP, with agriculture in Myanmar slightly later at 5000 BP (Glover and Bellwood, 2004, p.154). The minimal evidence in northern Vietnam and Laos dates to 6000 BP (Bellwood, 2004, p. 131). There is more evidence for Thailand from the Non Nok Tha hamlet, Ban Chiang village, and Khok Phanom Di dating to 5500 BP (Murphey, 1996, p. 12; Glover and Bellwood, 2004, p. 50; MacNeish, 1991, p. 267; Bellwood, 1979, p. 132). Evidence of rice cultivation from Samrong Sen in Cambodia is placed at 4500 by Stark in Glover and Bellwood (2004, p. 91). Farming spread from central Thailand into Malaysia at 4500 BP (Glover and Bellwood, 2004, p. 315), a date which we assign to Singapore as well. Diamond (1998, p. 342) places the Philippines at 5000 BP. Although some farming may have taken place in Indonesia just south of Singapore by 4500, most evidence from Indonesia is taken from Borneo at 4000 BP (Bellwood, 1979, p. 135, Diamond, p. 340). We assign this date for Brunei as well.

### Mongolia, Korea, Japan

Sources state that farming spread northward from China to the Tamsagbulag sites in Mongolia at 5000 BP (Dani and Masson, 1992, p. 174). Millet-based agriculture, accompanied by domesticated pigs, sheep, and goats spread from north China to Korea by 4500 BP (Murphey, 1996, p. 17; Barnes, 1999, p. 170; Gosden and Hather, 1999, p. 151). Agriculture in Japan is somewhat less certain, with some placing the date as early as 5000 BP; most sources date agriculture to 4500 BP as evidenced by agriculture at the Torihama site (MacNeish, 1991, p. 165, Kuzmin, 2002, p. 238; Chard, 1969, p. 119).

### New Zealand, New Guinea, Australia, Mariana Islands

Bellwood (1979, p. 17) writes the “Maori ancestors with a full knowledge of grain agriculture colonized previously uninhabited New Zealand from tropical Polynesia about 800 BP. New Guinea and Australia, on the other hand, were not colonized by incoming agriculturalists,” a date confirmed by Diamond and Bellwood, *Science*. Although recent evidence shows that agriculture may have started in New Guinea in 7000 BP, more established sources cite 4000 BP (MacNeish, 1991, p. 265; Bellwood, 1979, p. 145; Gosden and Hather, 1999, p. 142). We place the date for Australia at 400 BP, when the first Europeans arrived there. Rice farming in the Mariana Islands is dated to 3500 BP (Hunter-Anderson, Thompson, Moore, 1995, p. 70).

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## EUROPE

Archaeological evidence suggests two main areas as the earliest cradles of settled agriculture: the area surrounding the Tigris-Euphrates lowland of Mesopotamia and the near-coastal areas of mainland Southeast Asia (Murphey, 1996, p. 11). European agriculture spread from the former area, and can be divided into southeast Europe (Turkey, Greece, Albania, Macedonia, Bulgaria, Serbia and Montenegro, Bosnia and Herzegovina, Croatia, Slovenia, Hungary, Romania, Moldova, Ukraine, and southwest Russia), central Europe and Scandinavia (Austria, Liechtenstein, Czech Republic, Slovakia, Poland, Germany, Denmark, Norway, Sweden, Lithuania, Belarus, Latvia, Estonia, Finland, northwest Russia), and western Europe (Greece, Italy, Malta, Switzerland, France, Luxembourg, Belgium, Netherlands, United Kingdom, Ireland, Portugal, Spain). The general trend of agriculture spread was from southeast to northwest and northeast.

### Southeast Europe (Turkey, Greece, Albania, Macedonia, Bulgaria, Serbia and Montenegro, Bosnia and Herzegovina, Croatia, Slovenia, Hungary, Romania, Moldova, Ukraine, Russia)

Clear evidence of early settlement in southwest Asia comes from Turkey, Syria, Iraq, Iran, and Jordan. Bellwood (1979, p. 52) cites the first farming in Turkey at Abu Hureyra at 10500 BP, while Wenke cites the better established site of Catal Huyuk in south central Turkey at 9500 BP (1999, p. 395). We place the date at 10000 BP. Agriculture spread across the Aegean Sea into Greece between 8000 and 9000 BP as evidenced by the Franchthi Cave, Grotta dell'Uzzo, and Argissa-Maghula sites, among others (Dennell [in Cowan and Watson], 1992, pp. 76 and 83; Wenke, 1999, p. 304), averaging 8500 BP. Sources place agriculture in Albania, Macedonia, and Bulgaria at 7500 BP (Wenke, p. 304; Dennell, 1992, p. 76; Price, 2000, p. 9), with slightly later dates in the northern Balkans.

Most of the evidence for the former states of Yugoslavia does not distinguish between the states (the exception is Slovenia, which Bellwood, p. 77, places at 7000 BP). However, differentiations between northern and southern Balkans allow us to place dates for Serbia and Montenegro at 7500 BP, with Bosnia and Herzegovina and Croatia at 7000 BP (Dennell, p. 72; Price, p. 9). These sites involved wheat, barley, pea, and lentil cultivation. Agriculture spread northeast into Romania and Moldova, with dates averaged at 7500 BP (Price, p. 16, Dennell, p. 87). The Koros culture spread from Romania and Serbia and Montenegro into Hungary in 7400 BP (Gosden and Hather, 1999, p. 241; Price, p. 9; Bellwood, p. 74). Continuing northwest, agriculture moved from Romania into Moldova, Ukraine, and southwest Russia. Christian (1998, pp. 74-75) cites the Cris/Koros culture as early as 8000 BP, but evidence of dependence on farming of barley, einkorn, emmer wheat, and flax occurred at 7000 BP. Price, p. 16, writes that about the same time, in the river valleys of Ukraine, similar sites appeared; others place the date slightly later, around 6500 BP. Although agriculture reached northwestern Russia in 3000 BP, it spread from the Ukraine into southwestern Russia in 5000 BP (Dennell, p. 87; Kuzmin, p. 238; Chard, p. 145).

### Central Europe and Scandinavia (Austria, Czech Republic, Slovakia, Poland, Germany, Denmark, Norway, Sweden, Lithuania, Belarus, Latvia, Estonia, Finland)

A lack of evidence characterizes Austria, Czech Republic, and Slovakia, but the spread of farming from the Balkans northwestward to Poland and Germany is well documented. Dates for

Poland are 5890 to 6100 BP, so we have averaged them at 6000 BP (Harris, 1996, p. 329; Cowan and Watson, p. 84; Zvelebil and Lillie [in Price, 2000], p. 83). Similarly, the local cultivation of cereals and use of domesticated livestock is evidenced in Germany at 6000 BP (Dennell, p. 85; Jochim [in Price, 2000], p. 187). We can infer that the arrival of agriculture in Austria, Czech Republic, and Slovakia took place at about 6500 BP. Agriculture spread from Germany into Denmark, Norway, and Sweden. From Germany, farming moved southwest into Switzerland at 5500 BP (Dennell, p. 80; Price, p. 15), a date we also use for Liechtenstein. Although some sources cite Denmark at 6000 BP, the evidence for a fully Neolithic economy with cereal cultivation is scarce until 5500 BP (Wenke, p. 275; Price, p. 299; Zvelebil and Lille, p. 83). Agriculture spread to southern Sweden in 5500 BP and to Norway slightly later, at 5000 BP (Dennell, p. 85; Zvelebil and Lille, p. 83).

The flow of farming into northeastern Europe was from Poland: the scarce evidence on Latvia, Lithuania, and Estonia places the transitions of all three countries at about 3700 BP (Zvelebil and Lille [in Price], p. 83). Farming in Belarus began in the fifth millennium; since a more precise date is not available, we assign it 4500 BP. The appearance of the Boat Axe culture at 4500 BP in southern Finland corresponded with the development of agriculture; however, it was not a significant part of the diet until 3500 BP (Price, p. 84; Harris, p. 329, Dennell, p. 87).

#### Western Europe (Greece, Italy, Malta, France, Luxembourg, Belgium, Netherlands, UK, Ireland, Portugal, Spain)

Agriculture spread into western Europe from Greece and into Italy. Wheat and barley were cultivated in Greece in 8500 BP, reaching Italy by 8000 BP (Price, p. 14; Wenke, p. 304). Minimal evidence is available for Malta, placing its transition at 7600 BP (Bellwood, 1979, p. 85). Farming then spread to southern France, reaching it at 7500 BP (Dennell, p. 87; Price, p. 14; Bellwood, p. 75). Einkorn, emmer, wheat, and barley spread into northern Spain around 7200 BP, with evidence in southern Spain at the Coveta de l'Or site at 6500 BP (Diamond, p. 181; Dennell, p. 83). We assign this latter date to Portugal as well.

Farming moved from northern France into Belgium in 5500 BP (Price, p. 14; Wenke, p. 561), a date which we also assign to Luxembourg. Evidence for the Netherlands dates to 6000 BP (Price, p. 14; Wenke, p. 561). Farming also spread from France into the United Kingdom and Ireland. Multiple sources cite cereal cultivation in the UK at 5500 BP (Dennell, p. 86; Woodman [in Price], p. 256; Wenke, p. 304; Diamond, p. 181; Price, p. 17). Agriculture reached Ireland slightly later, at 5000 BP (Woodman in Price 237).

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## WEST, CENTRAL, AND SOUTH ASIA

Bellwood writes that “focused within the two and a half millennia from 8500 to 6000 BP, the farming system that developed in SW Asia spread over vast areas of the Old World—to Britain and Iberia in one direction, to Turkmenistan, the Altai Mountains, and Pakistan in the other; as well as to Egypt and North Africa. At the other end of Asia, East Asian agricultural systems were also on the move by this time, reaching toward Southeast Asia and eastern India (Bellwood, 1979, p. 67). To trace the spread of farming into west, central and south Asia, we have divided the region into two sub-regions: Fertile Crescent and south (Lebanon, Israel, Jordan, Cyprus, Syria, Iraq, Kuwait, Saudi Arabia, Qatar, Bahrain, United Arab Emirates, Oman, and Yemen) and Fertile Crescent and northeast (Iran, Armenia, Azerbaijan, Georgia, Turkmenistan, Uzbekistan, Tajikistan, Kyrgyzstan, Kazakhstan) and southeast (Afghanistan, Pakistan, India, Nepal, Sri Lanka).

### Fertile Crescent and south (Lebanon, Israel, Jordan, Cyprus, Syria, Iraq, Kuwait, Saudi Arabia and Yemen, Qatar, Bahrain, United Arab Emirates, and Oman)

Murphey writes that “there is clear evidence of early settlement in southern Anatolia (modern Turkey), Jordan, northern Iraq, and western Iran. By about 9000 BP...cultivated wheat, barley, and peas had clearly evolved into more productive forms than their wild ancestors, probably through purposeful selection by the cultivators” (Murphey 1996, p. 11). There is little differentiation between sites in this region: examples are Jericho in Jordan, Catal Huyuk in Turkey, Jarmo in northern Iraq, Hassuna and Ali Kosh in western Iran. Many sources place the date of farming at 10500 BP, earlier than Murphey (Wenke, 1999, p. 299; Bellwood, 1979, p. 58) so that is the date we employ for Lebanon, Israel, and Jordan. Dispersal into Cyprus took place at 8500 (Wenke, p. 71). Dates for Syria vary from 10500 BP to 10000 BP at Tell Mureybit; because evidence of domesticated features in emmer and einkorn were not present until the later date, we choose 10000 BP (Wenke, p. 297; Bellwood, p. 48) Dates for Iraq are slightly later, at 10000 BP, which we also assign to Kuwait.

The evidence for Saudi Arabia and neighboring countries is scarce, although farming had spread to Egypt by 7200 BP. It is likely that some small degree of farming was evident in northern Saudi Arabia before then, but substantive agriculture was not until that late date. We also assign this date to Yemen (Bellwood, p. 110). Estimates for Bahrain, Qatar, United Arab Emirates, and Oman come from the site of Tal-e-Malyan in southern Iran, which featured farming at 7500 BP.

### Fertile Crescent and northeast (Iran, Armenia, Azerbaijan, Georgia, Turkmenistan, Uzbekistan, Tajikistan, Kyrgyzstan, Kazakhstan)

Agriculture reached Iran at 9500 BP as evidenced by the sites of Ali Kosh and Ganj Dareh (Wenke, 1999, p. 299; Bellwood, 1979, p. 63). Farming continued eastward, with much evidence in Afghanistan and Pakistan as well as northeastward into Turkmenistan. Some farming is evidenced in the area just north of Iran in the Caucasus Mountains. Christian (1998, p. 80) writes that “the first Neolithic communities of the Caucasus belonged to the Shulaveri-Shomutepe culture” that grew wheat crops and kept livestock at 8000 BP. Bellwood agrees, citing sites from the eastern hinterlands of the Black Sea on the Kura River (85). We assign Armenia, Azerbaijan, and Georgia this date.

On the other side of the Caspian Sea, evidence for early agriculture in Turkmenistan is abundant. Bellwood places the appearance of the first agricultural communities in Turkmenistan at 8000 BP as evidenced by the site of Jeitun (Bellwood, p. 85). Although it is possible that “the transition to [an] economy of production was already complete in this part of Central Asia by 9000 BP” scholars generally point to 8000 BP (Dani and Masson, 1992, p. 121 and p. 225; Christian, p. 70). Evidence for Tajikistan is somewhat later, at 7000 BP (Dani and Masson, p. 225), with Uzbekistan, Kyrgyzstan, and Kazakhstan at 6500 BP (Dani and Masson, p. 169).

#### Southeast (Afghanistan, Pakistan, India, Nepal, Sri Lanka)

Moving from Iran to the southeast, archaeological evidence for Afghanistan dates to 9000 BP at Aq Kupruk (Dani and Masson, p. 196; Wenke, p. 488). Bellwood writes that “the agricultural movement that gave rise to the Zagrosian agricultural Neolithic by about 9500 BP continued on to reach Pakistan...at the remarkable site of Mehrgarh in Baluchistan by 9000 BP” (p. 84). This site featured barley and wheat remains (Wenke, p. 488; Murphey, p. 11). Diamond (p. 181) writes that “soon after food production arose [in the Fertile Crescent], somewhat before 10000 BP, a centrifugal wave of it appeared in other parts of western Eurasia and North Africa...the wave had reached Greece and Cyprus and the Indian subcontinent by 8500 BP.” Evidence for Nepal is slim, but agricultural remains from northeast India suggest that the area may have been farmed by 6000 BP (Bellwood, p. 89). South of India, in Sri Lanka, the transformation to farming is cited at 5000 BP (Britannica Online).

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