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The Impact of Globalization on the Forest Products Industry

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Introduction

As is the case in many other industries, the forest industry has undergone profound changes in recent years. Traditionally, the forest industry was primarily an extractive industry that relied on local sources for its basic resource, raw wood, most often in the form of logs (roundwood). Wood was extracted from the regions where nature placed. Wood is a low-value, high-volume resource that requires substantial transportation costs so that raw wood typically was logged from natural forests, and the early stages of processing, e.g., sawing for lumber and pulp production, was undertaken nearby. These features gave forest-rich regions a comparative advantage in both the production of raw wood and the early stages of processing. Generally, the output of the forest was largely consumed locally.

With the advent of globalization and the ability of humans to influence, indeed chose the location of the raw wood by establishing planted forests, this model of forest production has become somewhat obsolete.

Our study demonstrates that today the forest industry is experiencing seismic changes. Intensively managed, planted forests are replacing natural forests as the basic source of the wood resource, and producers of forest products are using modern biotechnology to produce trees that grow rapidly and have traits desired in industrial wood. These changes, which eliminate the traditional ties between forest processing and locations with abundant natural forests, are evidenced by the dramatic shifts in forestland ownership and production locations experienced in the past decade. U.S. forest corporations have divested themselves of almost 50 percent of their forestland holdings in the past 25 years—half of that in the past decade—even as they are purchasing forestland offshore. At the same time, the industry is planting almost one million acres of trees annually in the United States; nonindustrial forest owners are planting another one million acres annually—often on sites that were not recently forested.

Using a simple process of examining regional production through time, we demonstrate that the globalization hypothesis is supported for important elements of the forest industry—particularly pulpwood and pulp production.

The Globalization of the Forest Products Industry: the Concept and Some Data

What is Globalization?

Globalization is a condition that allows investments, capital flows, and emerging technologies to move easily into regions where they are expected to be particularly productive. It also allows for the ready use of the human resources of foreign countries, often

in those countries; thus, offshore outsourcing is closely associated with globalization. The easy flow of productive factors results in a mix of in-country and external contributions to the production of goods and services. In forestry, this process takes on an additional dimension in which the basic resource itself, the forest, can be relocated to capitalize on the cost advantages of particular regions. Additional changes have been driven by modern biotechnology, which has dramatically increased overall forest productivity and the variety of areas where productive forests can be grown.

It is widely recognized that globalization is occurring in many industries throughout much of the world.

We find that substantial evidence in country-level forestry data supports the hypothesis that globalization has begun to reshape much of the forest products industry. However, the evidence suggests that such changes have been more prominent in the pulp and paper industry than in the solid and structural wood sectors, e.g., lumber and panels.

Background

Fifty years ago, almost all industrial wood was harvested from natural forests. Today, about one-third of industrial wood comes from plantation forests Carle et al 2002) and it is estimated that this percentage will grow to about 75 percent by 2050 (Sohngen et al. 1999). While many of these planted forests simply replaced the natural forests that had been harvested, others involved the establishment of new forests in new locations. Initially, the transition from a regional resource-processing model to a more diverse globalization production and trading pattern was facilitated by the availability of low-cost transportation, which allowed for the substantial transport of raw wood from resource-rich regions to resource-poor regions. The quintessential example is the flow of logs and wood chips from North America to Japan from the late 1960s to the early 1990s. During this period, the raw material was in many cases transported to the final market, where processing took place. However, this was not typical and resulted from the unique combination of low-cost offshore wood for the Japanese, specifications unique to Japan that required unique milling dimensions, and the low cost of labor in early post-World War II Japan, which made the country suitable for the labor-intensive nature of the specializing milling. In this case, the capital and labor associated with logging and local transport was North American, whereas the intermediate and final processing was undertaken with Japanese capital and labor.

The opening of regions to external investments and technologies globalization has facilitated, not only the relocation of processing facilities, but subsequently the relocation of the forest itself (Sedjo 1983; Bowyer 2004). Innovations in silviculture have rendered reliance

on existing natural forests increasingly unnecessary. This change stems from a growing concern about the adequacy of future sources of timber supplies from natural forests, especially in light of the forest protection set-asides that are occurring as a result of environmental concerns. A second factor has been the finding that intensive forest management on select sites can dramatically increase biological growth rates making planted forestry an economically profitable investment under the appropriate set of conditions. Additionally, silviculturists found that certain trees grow much more rapidly as exotics in foreign environments than in their native habitats; thus, a broader array of tree species could be considered. Finally, in the context of large-scale tree planting, the application of tree breeding and modern biotechnology to forestry increased tree growth and yields even further.

In essence, a shift has occurred in comparative advantage from regions that are abundant in forest resources, which have typically been temperate industrialized regions, to regions that have an abundance of the cheaper factors of production (labor, land, and capital) and more favorable growing conditions for planned forest plantations. The latter typically are subtropical and tropical areas, generally in developing regions. Thus, just as globalization has been associated with offshore production from low-cost developing regions to relatively high-cost developed regions, forestry has seen a similar shift in comparative advantage from temperate developed countries to tropical developing countries.

These factors led to the realization that forests and forest management could be customized to a region and, indeed, to a site. However, a certain set of conditions would be necessary for forest productivity to increase dramatically. For example, forests need to be established in locations that are favorable from both a biological and an economic perspective. These locations need not have been forested previously, although many have been. In some of these locations, conditions are more favorable for exotics than for indigenous tree species. New, foreign locations are often set up on low-cost sites—many of which previously were agricultural lands in marginal use or grassland areas—that can generate high-yield forestry. With the decline of agriculture in some areas (for example, the cotton and tobacco fields of the U.S. South in the post-World War II period), such lands became open to forestry. Until the late 1970s, the center of American timber production was the old-growth forests of the Pacific Northwest. During the 1980s, the center of U.S. industrial wood production shifted to the South. This was due, in part, to changes in the use of timber from the National Forest System; more importantly, however, this shift was facilitated by the substantial reforestation that had taken place in the South, initially through natural regeneration of abandoned agricultural lands, and subsequently through intensive planting efforts that began in earnest in the 1960s and were accelerated in the 1980s. More recently, planted forestry has succeeded in a variety of offshore settings, including abandoned pastures in New Zealand and Australia; marginal croplands in Brazil, Chile, and other parts of South

America; grasslands in parts of South Africa, Argentina, and Uruguay; and lands in China and Indonesia.

Changes in employment levels and patterns have been associated with the advent of plantation forestry. According to the past model of regional resource processing, labor used in the logging and processing of wood typically was drawn from local populations. Regions with limited supplies of raw, industrial wood usually found it necessary to import wood products—most commonly in the form of processed or semi-processed intermediate products such as paper or lumber—that would then be used locally to produce the final goods desired by that society. Thus, the location of the natural forest to a large extent determined the location of the processing and the associated employment. However, the forest products industry is moving from a foraging operation, which uses the bounty of natural forests, to a cropping mode, which involves planting, tending, and harvesting. One implication is that a wholesale restructuring of processing and employment is likely.

Additionally, with the emergence of planted forests has come an incentive for tree improvement. Forestry first approached this task through traditional breeding approaches. As part of this process, forestry research has moved into the broad area of biotechnology, including tissue culture, genetic marking, and genetic transformation (Strauss and Bradshaw 2004). New employment will be generated in sophisticated plant-breeding and tree nursery activities, as well as in direct planting, intensive management, harvesting, and subsequent wood processing.

Over the past decade, the process of globalization has dramatically changed the forest products industry itself. In the United States, the industry has been divesting its ownership of forestlands. In the past 25 years, industry lands in the United States have been reduced by 50 percent, with nearly half of that decline in the past decade. Simultaneously, the industry has increased its ownership of offshore forestlands (Wilent 2004). These changes also are reflected in the trade balance: during the 1990s, the U.S. forest products trade balance deteriorated markedly from modest surpluses in the early 1990s to substantial deficits by the late 1990s.

In recent years, the distinction between domestic and foreign forest product firms has blurred as both groups have acquired forest holdings and processing operations outside their original countries and regions. This trend is not unique to the United States, as Lonnstedt (2006) has found the same trend among Nordic forest products companies. This shift is consistent with the hypothesis that globalization has shifted the comparative advantage in industrial wood production from the temperate forests of the world to elsewhere. Thus, in the context of the fluidity associated with changing technologies, economic openness, and globalization, it has become feasible for national firms to move beyond their traditional

boundaries and to become multinational through land and forest acquisitions or partnerships developed with foreign firms.

The Conceptual Model

Traditionally, the early stages of processing, e.g., sawmills and pulpmills, have tended to locate near the forest resource for the first step in processing, and the sawnwood and pulp have then been transported to locations where sawnwood was used in construction or the production of wood products, and pulp was used for the production of various types of paper. This type of production lends itself to an integrated operation in which a firm controls production from forestland ownership and harvesting through production of structural wood products and pulp and paper.

However, as Bjorn Hagglund (2006) suggested, if humans were starting a wood processing industry de novo, a simple conceptual model might suggest a location pattern of resource exploitation and development beginning with exploitation of the natural resource of appropriate quality and accessibility, and moving through the processing steps to the production and consumption of final products in consumer markets. Should we have the ability to choose forest locations, we would surely establish them in regions with high forest productivity, ease of resource accessibility, and low-cost transportation to further processing and markets. The global industrial forest system appears to be evolving to fit that model. Investments in high-yield plantation forests allow for the selection of desired sites. Typically, the early stages of processing are located near the forest, whereas the later stages, e.g., the production of specialized paper and certain construction materials are is typically located near the final market. In some cases, such as furniture, the production location is largely unrelated to the wood resource but highly influenced by labor cost considerations. Thus, for example, much of the U.S. furniture industry has moved from North Carolina to China.

Finally, transportation considerations are important to this model and suggest that pulp production will almost always be located near the wood resource. Paper production is another matter. Although there are technical advantages in a continuous process moving from pulp production directly to paper production, thereby avoiding the need for drying and rewetting of the pulp, there are also advantages to producing paper close to the market. These advantages include the relative ease of pulp transport, with low risks of damage, compared with the transportation of a paper product that is more susceptible to damage. The farther a product moves from the natural resource in the production process, the less important the resource location. Often, a good indicator of economic distance from the resource is the share of total value added provided by the natural resource.

Methodology

To test the hypotheses of the effects of globalization on the forest products industry, we examined the industry throughout the world. An analysis that includes statistics and graphs was done by Bael and Sedjo (2006).

The analysis looked at production from three different perspectives.

- **Forest products production**. Where are forest products being produced and how have production patterns shifted over the past few decades? Our expectation is that, generally, forest products production has decreased in industrialized temperate regions, with an accompanying increase in production in developing tropical regions where factors of production are cheap and abundant and where growing conditions more favorable for planned forests tend to occur. How have these patterns differed depending on which forest products are examined?
- **Plantations**. We would expect an overall increase in forest plantations throughout the world as forestry has shifted from a foraging industry to a cropping industry. In particular, we would expect disproportionate increases in plantations in tropical developing regions, again resulting from favorable economic and biological conditions in these areas.
- **Employment**. Just as other industries have moved both production and services offshore to regions endowed with cheap and abundant supplies of labor, we expect that forestry has followed a similar course. Thus, we expect employment in the forest products industry to have increased in tropical developing (labor rich) regions and diminished in industrialized temperate (labor poor) regions.

To examine these three areas, two data sources were consulted. The *Global Forest Resources Assessment 2005*, by the United Nations Food and Agriculture Organization (FAO), contains forestry-related data for 229 countries and territories throughout the world for 1990, 2000, and 2005. Data gleaned from this report include total forest wood product removals, productive plantation area, and forest sector employment. The FAO also maintains a forest products database (http://faostat.fao.org/faostat/collections?version=ext&hasbulk=0&subset=forestry) with more detailed information on production and consumption of several different forest products, including industrial roundwood, sawnwood, pulpwood, and wood pulp. This database has data on 230 countries and territories through 2004. This database was consulted for more specific production data for particular forest products. Because this database is not limited to the three data points (1990, 2000, 2005) included in the *Global Forest Resources Assessment*, forest products production was considered over the continuous period 1980–2004. We believe that looking at forest production over this time frame will reveal the impact of globalization on the industry.

Results

Forest Timber Products Production

When examining the productive functions of forests, the primary distinction to be made in forest wood products is between fuelwood and roundwood.[1] Total global wood removals in 2005 amounted to 2.8 billion m^3, of which about 50 per cent of this is fuelwood is not considered in this analysis. Roundwood (logs), on the other hand, which are logged specifically for use in industrial purposes, such as pulp, paper, lumber and panels is a commodity that is traded internationally and its production is a primary focus of this analysis.

The FAO *Global Forest Resources Assessment 2005* provides data for industrial roundwood removals (i.e., production) for 1990, 2000, and 2005. Of the 229 countries and territories surveyed in this report, industrial roundwood removals data (in cubic meters) are available for 153 countries for all three years. These data were compiled for this analysis and aggregated into 13 regions:

- Eastern and Southern Africa
- Northern, Western, and Central Africa
- East Asia
- South and Southeast Asia
- Western and Central Asia
- Europe (excluding Nordic countries and former Soviet countries)
- Nordic Europe
- USSR and former USSR
- Central America and the Caribbean
- United States
- Canada
- Oceania
- South America

[1] Nonwood forest products consist of plant and animal products used for food, fodder, medicines, and other purposes and are not considered in this analysis. As is the case with fuelwood, they generally are harvested or foraged for local consumption (often for subsistence purposes) and thus are less likely to reflect the impact of globalization.

Collectively, these 13 regions encompass all of the countries and territories in the world for which data are available. The delineations of these regions were chosen to attempt to separate tropical areas from temperate areas and developed regions from developing regions. The United States and Canada were each considered regions in themselves because of the large volume of production in each country. The data are presented in 25 graphs in Appendix D and Figures 1 and 2. Appendix A provides a complete list of countries and territories by region. Figure 1 depicts total roundwood removals for each region for each of the three years, and Figure 2 shows the proportions of total world production for each of the regions for each of the three survey years.

The following sections discuss the data and the graphs.

Industrial Roundwood Production

Industrial roundwood is the most all-encompassing forest wood product. It includes sawlogs and veneer logs; round and split pulpwood (FAO 2002). Essentially, roundwood encompasses all the wood products harvested from forests other than fuelwood.

Value Added

Total gross value added of the forestry sector remained relatively stable during the 1990s at US$ 354 billion in 2000. The pulp and paper industry accounted for about 50 percent of this total, whereas the solid wood industry accounted for 30 percent and forestry activities accounted for the remaining 20 percent. The developed regions accounted for the majority of the value added of the wood industry (85%) and the pulp and paper industry (80%). However, these shares fell during the 1990s as the value added of Latin American and Asian-Pacific regions increased. Overall value added per unit output eroded somewhat during the 1990s because of declining roundwood prices. During that decade, the contribution of the forestry sector to the gross national product declined from just under 1.6 percent to just over 1.2 percent, reflecting the overall expansion of global gross domestic product (GDP) while forest sector value added remained essentially unchanged. Most regions displayed the same downward trend in forest sector GDP share except Latin America and the Caribbean and Eastern Europe, where the share increased.

To obtain more detailed data than can be gleaned from looking at the three survey years presented in the FAO *Global Forest Resources Assessment*, we consulted the FAO Forest Products Database. Industrial roundwood production data (in cubic meters) are available for 173 countries and territories. Country-level data were aggregated up to the 13 regions listed above and production data were considered going back to 1980. Overall, world

industrial roundwood production fluctuated somewhat between 1980 and 2004, with a net increase of 14 percent from 1980 to 2004.

The data show that most regions increased industrial roundwood production over this time frame. The one glaring exception is the former Soviet nations. At the time of the breakup of the Soviet Union in 1991 and in the ensuing transition years, production in these nations diminished significantly from a high of more than 300 million m^3 between 1988 and 1990 to less than 100 million m^3 by 1994.

The data also show that the more industrialized and developed regions of the world (almost entirely in temperate zones)—the United States, Canada, and Europe—have been the largest producers of industrial roundwood. The more subtle changes in production in the smaller producing regions are swamped by the larger producing regions and can be hard to see in the graphs. Thus, to attempt to depict the dynamics in developing tropical regions, an additional set of graphs was generated that excludes the United States, Canada, and Europe (Nordic, non-Nordic, and all of the former Soviet bloc, even though much of Russia and some other former Soviet states are actually in Asia).

Of the smaller producing regions, South America showed the most notable increase in industrial roundwood production, going from 85 million m^3 (or 5.9 percent of world production) in 1980 to 164 million m^3 (9.9 percent of world production) in 2004. This upward trend for South America was fairly consistent over the entire 25-year time span. No other region showed as marked an increase or decrease over this time frame. East Asia (which includes China) showed a minor increase in industrial roundwood production throughout the 1980s but declined after 1988, resulting in a near zero net change over the entire time frame. South and Southeast Asia showed a similar pattern, with production levels in 2004 very close to what they had been in 1980. Oceania also showed a steady upward trend—although not nearly as dramatic as South America—from 28 million m^3 (1.9 percent of world production) in 1980 to just under 50 million m^3 (2.9 percent of world production) in 2004. The two African regions showed only slight (but steady) increases in industrial roundwood production over this time frame, while Central America and the Caribbean and North, West, and Central Asia remained relatively constant.

Sawnwood Production

Sawnwood is a more processed forest product that is further along in the production chain than industrial roundwood. Whereas industrial roundwood production represents the direct harvesting of raw wood from forests, sawnwood is produced from by sawing roundwood (logs) lengthwise or by a profile-chipping process (FAO 2002). As described in

the introduction, the processing of the resource into wood products may not be as close in proximity to the timber harvesting sites as was the case a few decades ago.

The FAO Forest Products Database includes sawnwood production data for 163 countries over the period 1980–2004. Again, these data were aggregated to the 13 regions listed above. Total world production has fluctuated over this period. From a level of 420 million m^3 in 1980, production increased to a high of just over 470 million m^3 in 1988 before declining steadily throughout the 1990s; a slight resurgence occurred since 2001. Overall, from 1980 to 2004, world production of sawnwood decreased by 1.3 percent.

Again, the data show a precipitous decline in production in the countries at the time of their transition away from the Soviet Union in the early 1990s. The USSR was by far the largest producer of sawnwood throughout the 1980s, but by the late 1990s the former Soviet countries collectively were only the sixth-largest producing region of sawnwood. Since 1991, the United States has been the largest producing region of sawnwood, and since the mid-1990s, Europe (excluding Nordic countries and former Soviet countries) has been the second-largest producer and Canada has been the third-largest producer.

To capture the changes in the smaller producing developing regions, the temperate industrialized regions, which are also the largest sawnwood producing regions (United States, Canada, and Europe) were excluded, and the absolute levels of sawnwood production for the eight remaining regions were examined in isolation. The most dramatic trend seen in these data for sawnwood production is in East Asia, in which production declined from a peak value of nearly 64 million m^3 (nearly 15 percent of world production) in the mid-1980s to about 30 million m^3 (7.4 percent of world production) in 2004. Steep declines in both China's and Japan's production over this time frame account for the bulk of this change. No other region shows nearly as dramatic a change over this period. South America showed a steady increase over the entire time frame, although not nearly as dramatic as its industrial roundwood production increases. South America increased sawnwood production from 22 million m^3 (5.2 percent of world production) in 1980 to 35 million m^3 (8.5 percent of world production) in 2004. South and Southeast Asia showed steady increases throughout the 1980s, going from 27 million m^3 (6.5 percent of world production) in 1980 to its peak of 41 million m^3 (8.8 percent of world production) in 1990. In the 1990s, however, production declined to a low of 25 million m^3 (6.5 percent of world production) in 2001, before climbing back up slightly in recent years. Oceania again showed steady, but only slight, increases over this time frame, while all other regions remained relatively constant.

Pulpwood Production

Pulpwood constitutes the portion of roundwood that will be used for the production of pulp, particleboard, or fireboard. Again, it is a wood product that is further along in the production chain than raw industrial roundwood (FAO 2002). Traditionally, pulpwood production has been much more prevalent in industrialized countries, but the effects of globalization are likely to be seen as pulpwood production is separated from industrial roundwood production.

The FAO Forest Products Database has pulpwood production data available for 99 countries over the period 1980–2004.[2] Again, these data were aggregated to the 13 regions listed above. Total world pulpwood production has steadily increased throughout this period from 370 million m^3 in 1980 to 522 million m^3 in 2004, an increase of 41 percent. Pulpwood production in the United States has accounted for about one-third of total world production and dwarfs production levels in many other regions. U.S. production increased slowly but steadily throughout the evaluation period. The Soviet bloc again showed a sharp decline in the early 1990s but, unlike the other forest timber products considered, pulpwood production has shown a dramatic resurgence since the late 1990s to levels that are significantly above the period prior to the dissolution of the Soviet Union. In fact, since the late 1990s, Russia has been one of the largest single-country producers of pulpwood, second only to the United States.

Again, to capture the changes in the smaller producing developing regions, the largest sawnwood (lumber) producing regions (United States, Canada, and Europe) were excluded and the absolute levels of pulpwood production for the eight remaining regions was examined. Similar to the trends for industrial roundwood, South America showed the most dramatic trends in pulpwood production: its production increased from just over 26 million m^3 (7.2 percent of world production) in 1980 to more than 71 million m^3 (13.7 percent of world production) in 2004. This increase was relatively consistent over the entire time frame. Again similar to industrial roundwood production, East Asia showed slight increases in pulpwood production throughout the 1980s and declines ever since. Oceania showed slow but steady increases throughout the time frame to become the second largest producing region (out of these eight regions) by the early 2000s; most of this is due to Australian production. Eastern and Southern Africa also showed moderate increases throughout this time frame, from 6.8 million m^3 (1.8 percent of world production) in 1980 to 15.5 million m^3 (3 percent of world production) in 2004. South and Southeast Asia showed steady increases throughout the 1980s and early 1990s (ranging from 3.2 million m^3, or 0.9 percent of world production, in 1980 to 13.9 million m^3, or 3.3 percent of world production, in 1996), but then fell rather

[2] In 1998, the FAO Forest Products Database changed its term for pulpwood from "Pulpwood and Particles" to "Pulpwood, Round & Split."

precipitously throughout the late 1990s; this may have been due to the 1997–1998 Asian financial crisis. Other regions showed very little change and continued to be very low-level producers throughout this time frame.

Wood Pulp Production

Wood pulp includes fibrous material prepared from pulpwood, wood chips, particles, residues, or recovered paper for further manufacture into paper, paperboard, or other cellulose products (FAO 2002). Pulp production also has traditionally been far more prevalent in industrialized countries. The FAO Forest Products Database has wood pulp production data available for 85 countries over the period 1980–2004. Total world production of pulp increased by 39 percent from 1980 to 2004, from 126 million metric tons in 1980 to 175 million metric tons in 2004. The United States has been by far the biggest producer of wood pulp over this time frame, more than doubling the production of each of the regions with the next largest volumes of wood pulp production (Nordic Europe and Canada). Pulp production in the United States, however, has not increased consistently during this period. Throughout the 1980s and early 1990s, U.S. pulp production did increase steadily, reaching a peak of almost 66 million metric tons in 1994. Since 1994, however, U.S. pulp production has diminished in both absolute and relative terms. Meanwhile, almost all other regions have stepped up their pulp production since 1994.

Again, we examined the changes in the smaller producing regions, excluding the largest producers of wood pulp (United States, Canada, Europe, and Russia). Of the eight remaining regions, East Asia is the largest producer of wood pulp, although its share of world production has remained relatively constant at about 9 percent over this time frame. In contrast, South American pulp production increased steadily and dramatically throughout the entire time frame from just over 4 million metric tons (or 3.4 percent of world production) in 1980 to more than 14 million metric tons (8.1 percent of world production) in 2004. During this time frame, East Asian pulp production only increased from around 11 million metric tons to just over 15 million metric tons. South and Southeast Asia also showed sharp increases during this time, predominantly from 1990 on. In 1980, this region's pulpwood production was only 724 thousand metric tons (0.6 percent of world production), but by 2004, its production had increased to nearly 9 million metric tons (5.1 percent of world production). Again, the bulk of this increase took place from 1990 on. A more than 100-fold increase in pulp production in Indonesia from 1980 to 2004 accounts for a substantial share of this increase. All other regions showed relatively constant pulp production levels throughout this time frame.

Productive Forest Plantations

Forest plantations are defined as forests of introduced species, and in some cases native species, established through planting or seeding and characterized by few species, even spacing, even-aged stands, or a combination of these traits (FAO 2006). The two general types of forest plantations include productive and protective forest plantations. Productive forest plantations are defined as forest plantations that are predominantly intended for the provision of wood, fiber, and nonwood forest products (FAO 2006). Protective forest plantations are not intended for production but rather for conservation or for the ecosystem services that forests provide (e.g., biodiversity preservation and carbon sequestration). Protective forest plantations are not considered in this analysis because they are not a significant component of the wood used in the forest products industry. We hypothesize that productive plantations have disproportionately high growth rates in subtropical and tropical developing regions where labor is inexpensive and abundant and where growing conditions lead to more abundant and efficient tree growth. Meanwhile, we expect that productive plantations in industrialized temperate regions, where labor is more scarce and expensive and growing conditions lead to less efficient tree growth, have proportionately decreased.

The FAO *Global Forest Resources Assessment 2005* contains productive forest plantations data (in hectares) for the years 1990, 2000, and 2005. Of the 229 countries and territories surveyed in the report, data are available for 168 countries for all three survey years.[3] The total world productive forest plantation area was more than 109 million hectares in 2005, more than a 44 percent increase over the 76 million hectares of global productive forest plantations in 1990. We again aggregated the data into the same 13 regions listed above; however, because no data on forest plantations are available for Canada, the number of regions has been reduced to 12. The data are summarized in Figures 22–24. All 12 regions showed a net increase in productive forest plantation area over the 15-year period, but some regions showed significantly larger forest plantation growth than others.[4]

Total productive forest plantation area throughout the world increased from 76 million hectares in 1990 to 109 million hectares in 2005, with all regions showing positive growth. East Asia had the largest productive forest plantation area in each of the three years. This region also showed one of the higher growth rates in productive forest plantation area over this period. The region with the highest growth rate of productive forest plantation area over

[3] The FAO Forest Products Database does not include data on forest plantations, and no other data source provides continuous time series data for forest plantations over the time frame considered in this analysis.

[4] The productive forest plantation regional totals for 1990 and 2000 for the three regions that compose Europe (Europe, excluding Nordic countries and former Soviet countries; Nordic Europe; and USSR and fFormer USSR) have been extrapolated based on the proportions of the European total comprised of these regions in 2005. This is because, for 1990 and 2000, the FAO report only includes totals for Europe as a whole and does not differentiate among these three regions.

this period, however, was Central America and the Caribbean, which saw an average annual growth rate of 9.79 percent during this 15-year period; in comparison, the overall average annual growth rate in productive forest plantation area was 2.95 percent for the entire world.

Much of this growth, however, can be attributed to the relatively small area of forest plantation in this region; even at the end of this period, this region only had 0.5 percent of the world's productive forest plantation area.

The region that showed the largest increase in proportion of total world productive forest plantation area from 1990 to 2005 was the United States, which appears to contradict our hypothesis. In 1990, the United States had 10.1 percent of overall world productive forest plantation area, but by 2005, the United States had 15.6 percent. However, it should be noted that the data examined begin in 1990, by which time many regions had substantial plantation area, while others had virtually none. This suggests that the rest of the world may have already made much of the adjustment before 1990, when our data begins. Fopr example, growth rates from 1990 to 2000 were more rapid than those from 2000 to 2005. Thus, the United States share of world productive forest plantations increased from 1990 to 2000, from 10.1 percent to 17.1 percent, but then reversed itself and declined between 2000 and 2005 to 15.6 percent. From 2000 to 2005, many of the more tropical developing regions showed an increase in their shares of world productive forest plantations, including East Asia and Northern, Western, and Central Africa. Meanwhile, over this same five-year period, most of the more industrialized temperate regions showed a decline in their shares of world productive forest plantations, including, as noted above, the United States, as well as Europe, Nordic Europe, and the former Soviet Union.

Meanwhile, many of the other regions with vast areas of forest plantations, including East Asia, the Soviet Union, South and Southeast Asia, and Northern, Western, and Central Africa, showed declines in their respective shares—although not absolute amounts—of total productive forest plantation area. Many of these regions showed a decline in their share of total world forest plantation area between 1990 and 2000 but an upsurge between 2000 and 2005. For example, East Asia, which had 29.1 percent of world productive forest plantation area in 1990, showed a decline from 1990 to 2000 to 24.1 percent, but more rapid growth thereafter back up to 27.5 percent by 2005. This suggests that the impact of globalization on the location of productive forest plantations may be a more recent phenomenon.

Interestingly, South America, which has shown one of the more rapid growth rates for much of the forest industry outputs, has not shown rapid increases in forest plantation area since 1990. However, this region did experience substantial plantation establishment before 1990, as reflected in the relatively large area in 1990, and has continued to increase its plantation area.

Trends in International Trade and Prices

Although value added was quite stable, the real value of forest products exports rose almost 50 percent during the 1990s to reach US$ 144 billion in 2000. However, because total international trade grew so rapidly through the 1990s, the forest products share fell from 2.9 to 2.2 percent over that decade. Western Europe and North America together accounted for about 75 percent of world forest product exports, while the developing Asia-Pacific region accounted for 10 percent. Eastern Europe also has shown growth in forest products exports, although the value added of the sector in this region is low and declined in that decade. Latin America and the Caribbean and the developing Asia-Pacific region showed substantial trade expansion.

Real export prices provide some idea of the robustness of the wood markets. The 1990s saw solidwood prices (sawnwood and wood based panels) exhibit modest volatility while rising about 10 percent from 1990 to 2000 (Lebedys 2004, page 33). By contrast, pulp and paper export prices showed significant volatility while declining in 2000 to about 85 percent of the 1990 price. For both commodities, the share of global value added declined in the traditional producing countries while it increased in Latin America and the Caribbean and the developing Asia-Pacific region.

Forest Industry Employment

Based on our hypotheses of the reshaping of the global forest products industry by globalization, and, in particular, the movement of forestry production offshore, we would expect increases in forestry sector employment in developing countries where labor tends to be inexpensive and abundant, with concurrent employment decreases in industrialized countries where labor is relatively scarce and expensive. These employment increases also would reflect increased investments and new technologies introduced in regions with characteristics favorable to forestry. The available data on forestry employment are not extensive and are muddled with inconsistencies among countries in what is considered to be employment in this sector. The FAO *Global Forest Resources Assessment 2005* reports country-level forestry employment data only for 1990 and 2000; no forestry sector

employment data are available for 2005. As noted, 139 countries reported employment data for 2000, but only 116 countries reported for 1990.

In this context, the FAO defines employment as: "any type of work performed or services rendered under a contract of hire, written or oral, in exchange for wage or salary, in cash or in kind" (FAO 2006). This is based on definitions by the International Labor Organization and the Employment Security Commission. Most of the employment data presented in the FAO report relate to work done in the primary production of forest goods and related services; work done in the processing of wood and nonwood forest products is excluded (FAO 2006). Yet this data standard varies somewhat from country to country. For example, the United States included employment in sawmilling, thus resulting in a higher employment figure than employment in roundwood production alone. Other countries reported employment by public forest agencies where these agencies also own and manage forest processing facilities, again leading to overestimation of forest sector employment involved in primary production. Other countries, notably India, may also have overestimated forestry sector employment due to the inclusion of part-time workers without conversion to full-time equivalents. Finally, some of the forestry sector employment figures may include individuals who collect fuelwood and nonwood forest products for subsistence purposes, whereas the guidelines for reporting forestry employment stipulate that only paid employment should be included. These limitations in forestry employment data do not invalidate the results reported here, but rather suggest that it is hard to draw robust conclusions about global forestry employment and that further research with better data is needed to more fully characterize global forestry employment trends.

Total employment in the forestry sector for the 139 countries reporting in 2000 was just over 11 million (Table 1). For the 116 countries that reported employment for both 1990 and 2000, total employment decreased 9 percent over that period from 11 million in 1990 to just under 10 million in 2000 (Table 2). The forestry sector employed about 0.4 percent of the total global labor force in 2000, a figure that fell during the 1990s with global forest employment divided roughly equally among forestry activities, the solidwood industry, and in pulp and paper. Regionally, however, this situation may vary. In developing regions forestry activities tend to be more important than processing.

Latin America and the Caribbean and the developing Asia-Pacific region[5] are the only regions that showed a rapid expansion of employment in the forest sector during the 1990s. An estimated 1 million new jobs were created in these regions. Employment declines were recorded in Western and Eastern Europe and Japan. Most other regions had stable forestry employment over that period.

[5] Developing Asia-Pacific includes all countries in Asia and Oceania except Australia, Japan and New Zealand, which are classified as Developed Asia-Pacific.

Labor productivity rose significantly in the pulp and paper industry during the 1990s. A large increase in labor productivity was achieved by some of the world's largest pulp and paper producers: Australia, Brazil, Canada, Indonesia, and the Nordic countries all increased their labor productivity at least 40 percent over that decade. In the other activities, labor productivity remained essentially the same in most regions.

As was the case for forest timber production and productive forest plantations, the available data were aggregated into the 13 regions listed above. Table 1 presents the distribution by region of forestry sector employment in 2000. Of the 11 million workers employed worldwide in forestry, the vast majority were in Asia, where more than 8 million workers were employed. (India alone accounted for more than 5 million employees, while China accounted for nearly 2 million.)

Table 1. Worldwide Employment in Forestry in 2000*

Region	**Number employed (*1,000 person-years*)**
South and Southeast Asia	5,681
East Asia	2,122
Europe, excluding Nordic countries	504
Western and Central Asia	474
Northern, Western, and Central Africa	447
Eastern and Southern Africa	426
USSR, Former USSR	420
United States	281
South America	245
Central America and the Caribbean	234
Canada	89
Europe, Nordic	50
Oceania	37
World Total	***11,010***

* For the 139 countries reporting in 2000.

Regional trends in forestry employment between 1990 and 2000 are examined in Table 2. Note that the data in Table 2 are slightly different from those in Table 1 because only countries reporting data for both years were considered in Table 2.

Globally, for the reporting countries, employment in forestry declined slightly from 1990 to 2000, by about 1 million (or 10 percent). This may be attributable, in large part, to increases in labor productivity that have accompanied technological improvements throughout the world. Inspection of the results reveals that, whereas employment declines have occurred in Asia and Europe, many of the other regions, particularly the developing regions of Africa and South America, have shown increases in forest sector employment. Not

surprisingly, regions such as South America, which have had large increases in production of most forest products, also have seen substantial employment increases in the forest sector.

Table 2. Trends in Number of People Employed in Forestry 1990–2000*

Region	Number employed (*1,000 person-years*)		1990-2000 Percentage change
	1990	2000	
South and Southeast Asia	5,991	5,519	-7.9%
East Asia	2,647	2,122	-19.8%
Europe, excluding Nordic countries	614	365	-40.6%
Western and Central Asia	468	474	+1.3%
USSR, Former USSR	330	374	+13.3%
United States	311	281	-9.6%
Northern, Western, and Central Africa	255	367	+43.9%
Europe, Nordic	84	50	-40.5%
Central America and the Caribbean	83	145	+74.7%
Canada	74	89	+20.3%
South America	66	100	+51.5%
Eastern and Southern Africa	47	57	+21.3%
Oceania	35	37	+5.7%
World Total	***11,005***	***9,980***	***-9.3%***

* For the 116 countries reporting in both years.

In Europe, some of the decline in employment can be explained by productivity gains resulting from the restructuring of formerly centrally planned economies and the general privatization of forestry activities. The employment increases throughout much of the developing world probably reflect roundwood production that has increased faster than increases in labor productivity. This supports our hypothesis of the impact of globalization on the forestry sector.

Discussion and Conclusions

Overall, forest sector data show the features of an industry that declined globally during the 1990s. Overall, value added stagnated as the sector's share of global employment, GDP, and international trade, all declined. Only solidwood product prices showed strength, even as pulp and paper prices exhibited weakness. However, the performance of Latin America, the Caribbean, and the developing Asia-Pacific region have been contrary to this declining trend; only these regions have shown substantial forest sector expansion in value added, employment, and exports (Lebedys 2004, page 59).

We find substantial evidence in country-level forestry data to support our hypotheses that globalization has begun to reshape the forest products industry. However, the evidence suggests that, whereas the changes have been prominent in the pulp industry, they are largely absent in the solid and structural wood sector. We claim that technological innovations, including intensively managed plantation forests and greater mobility of labor and capital, have propelled a shift in the comparative advantage of pulp production from developed countries in temperate regions to developing countries in subtropical regions. In the latter regions, not only are the economic conditions generally more favorable to cheaper and more efficient production (e.g., lower land and labor costs), but biological conditions also tend to support faster growth and higher yields, which result in lower wood costs and shorter transportation to the mill. This is especially significant considering the transition of forestry from a foraging activity using natural forests to the cropping and harvesting of planted forests along the lines suggested by Sedjo and Lyon (1990). While there is no doubt that natural forests are still being cut and depleted in many parts of the world, there is clear evidence that productive forest plantation area is increasing throughout the world (FAO 2006) and that wood products are increasingly derived from them.

Globalization Interviews with Senior Company Officials

The Issue

The first part of this study examined statistics for the forest industry over the last several decades. Initially, we hypothesized that globalization is occurring in all industries that make up the forest products industry. However, early discussions with forest product industry leaders challenged that view, suggesting that increased globalization may be occurring in the pulp industry, but not in the structural wood industry. The reasons provided relate both to the structural characteristics of wood from fast-growing plantation trees and the costs of transportation of wood products. Wood from fast-growing trees tends to have lower strength and stability properties than wood from older and more slowly growing trees. If plantations are to become important in the structural wood industry, a slower growing period will be required for most products under current technology. Thus, any transition is apt to require more time before it becomes apparent. Also, wood transportation costs may be more constraining for structural wood products than for the more easily transported wood pulp.[6]

[6] Although some long-distrance transport has occurred for solidwood products (e.g. lumber from Europe to Japan and from Canada to Japan), long-distance solidwood transport is much less common than long-distance wood pulp transport.

The claims of industry officials are borne out by the statistical trends, which do not support the globalization hypothesis for the entire forest resource and products industry. Nevertheless, when the pulpwood and pulp industry are examined in isolation, the trends of the last few decades are strongly consistent with the globalization hypothesis. This finding was part of the preliminary information provided to senior industry officials and other experts. Appendix B provides a list of industry experts interviewed and Appendix C is a copy of the interview sheet that was provided at the beginning of most interviews. Although the officials interviewed all represent companies located in the developed world, several of these had major operations in the developing world. Also, some non-company experts had a great deal of developing world experience. However, although each interviewee had a chance to read through the interview sheet, the discussions almost always became wide ranging and no real attempt was made to follow the outline closely once the interviews had begun.

Generalizations from the Interviews

In this section, we draw some generalizations derived from the discussions with company officials and other forest industry experts. There was broad consensus that the forest industry is undergoing major changes. Some of these changes involve new markets that present new opportunities. The opportunities in China were mentioned regularly—both the potential for establishing investments in new forests and, perhaps more importantly from many companies' perspectives, the market opportunities. The logistics of trade with China were discussed in many of the conversations. The potential for wood production in South America was mentioned as often as China, if not more frequently.

Consistent with the pulp globalization hypothesis, companies with a primary focus on pulp and paper seemed to be particularly aware of the changes resulting from globalization, and the Nordic companies agreed that major adjustments in the composition of their assets are being made to try to adapt, although the types of changes often differed by company. Companies whose major products were solid and structural wood (with pulp and paper as secondary products) tended to view the situation differently. These companies, operating in an environment in which the North American housing market had been very strong, tended to see less globalization for their major products, such as structural wood and panels. However, many North American companies focusing on pulp and paper have made major moves to restructure their assets, including dramatic reductions in timberland holdings.

In both the North American and the Nordic countries, substantial asset restructuring and a significant degree of forestlands divestiture is occurring.

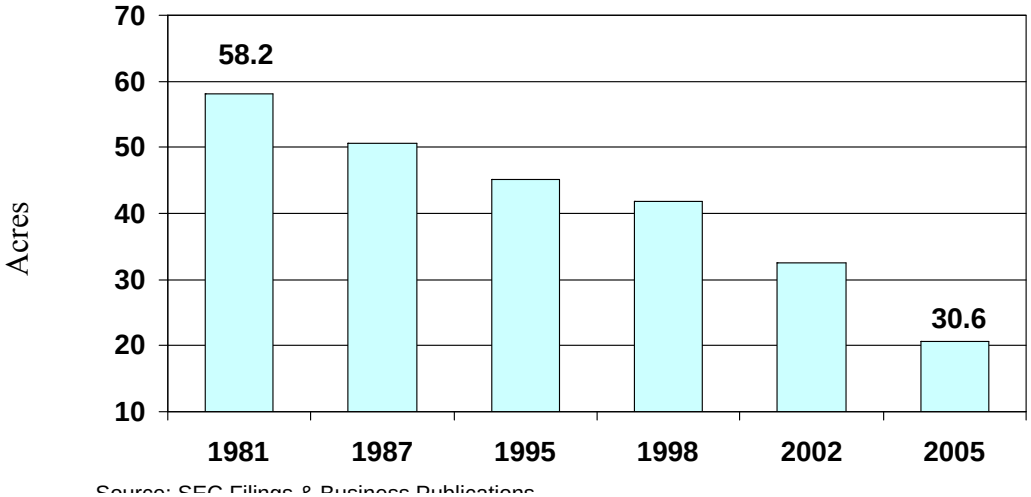

Figure 1. U.S. Timberland Held by Publicly Traded Companies (in Millions of Acres)

About one-half of the land owned in the United States by forest products corporations in 2000 had been divested by 2006 (Figure 1). An important driving force for this trend in the United States appears to be the tax structure, which results in higher taxes on corporate forestlands through the double taxation associated with corporations generally, which has raises forest corporation taxes for wood revenues above what would be required if they had another organization form, such as a Timber Investment Management Organization (TIMO).[7] A response has been the divestiture of forestland in various forms including the Timber Investment Management Organization (TIMO) (Figure 2), Real Estate Investment Trusts (REITs), and wholly owned subsidiaries of noncorporate business entities. For example, the structure of the integrated forest products corporation, Plum Creek (PC), was changed to a REIT structure. As a REIT, PC is now the largest land-holding company in the United States. The joint products of PC now are timber and land real estate. Regarding its timberlands, it appears that PC expects that greater value can be obtained from the timber if it is directed to the highest value uses and the company is not saddled with meeting the requirements of an existing mill, as is usually the case for an integrated operation.

[7] See (Scinta 2006) for an article discussing the restructuring of Weyerhaeuser Company and the role of taxes on the forestland holding decision. Recently, a bill was submitted to the U.S. Congress that would eliminate much of the double taxation on forests.

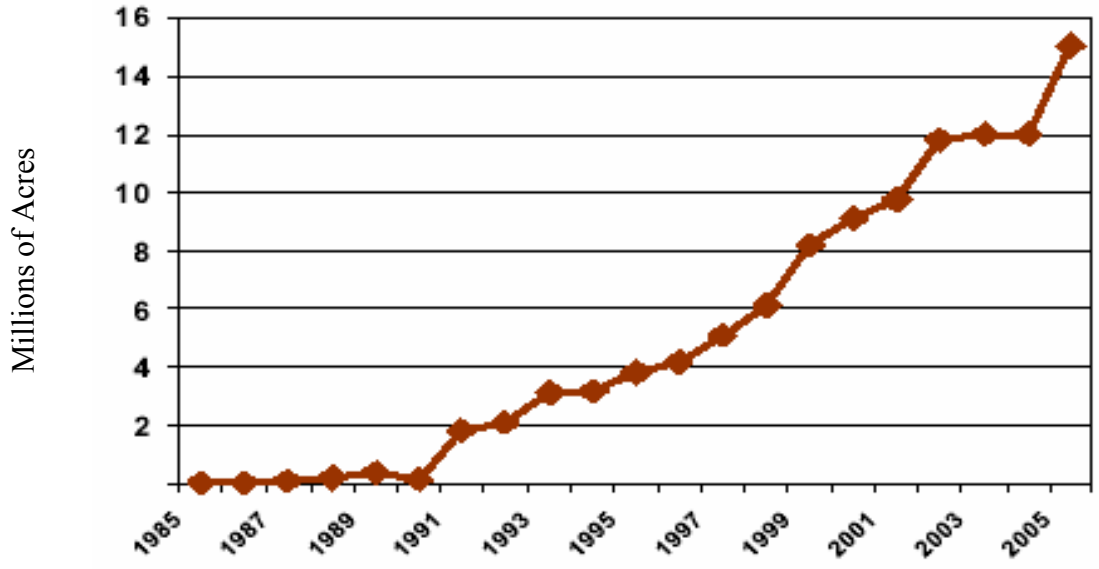

Figure 2. U.S. Timberland Held by Major TIMOs (in Millions of Acres)

A similar process of divestiture appears to be underway in Finland, and even more so in Sweden, where a relatively large proportion of the forestland had been corporate-owned. However, this process cannot be attributed to the tax structure, which is more even in the Nordic countries. A common complaint in both Finland and Sweden has been that the financial markets do not properly assess the value of the forestlands when valuing a company's financial worth. This was a rationale behind Georgia Pacific's (GP) formation of a separate company, The Timber Company (TC), with its timberlands around 2000. Initially, the TC was a wholly owned subsidiary of GP; subsequently it was sold and now is a part of PC, a timber holding REIT. However, the strategy was not particularly successful in improving the value of the stock of GP, which is now a private company wholly owned by Kock Industries. The Stora-Enso company has undertaken a similar process in selling much of its timberlands in Sweden to a new company, which is partly owned by Stora-Enso. However, this approach also has not been especially successful for improving the stock price of Stora-Enso.

The interviews revealed some differences in motivation between the forestland divestitures in North America and the Nordic countries. Perhaps the quintessential example of the application of the globalization hypothesis is one in which temperate forestlands are divested even as lands in more productive regions, such as the subtropics, are acquired. Behavior of this type seems to have been followed only by Stora-Enso. One could view Stora-Enso behavior as that of partial divestiture of lands in the Nordic region while adding to its forestland holdings in subtropical regions where trees grow rapidly, such as South America. Weyerhaeuser Company (Weyco) appears to have a similar strategy of acquiring forestlands in fast-growing regions such as Uruguay, except that it has not divested much

forestland in the temperate region. However, Weyco views its principal product as structural wood, for which the globalization hypothesis appears far less applicable than for pulp. Weyco also has a major arm of its operations in real estate sales and development.

For many other companies in the United States, forestland divestiture appears to be a strategy to separate the company from ownership of the resources; examples include International Paper and GP. In the Nordic countries, the strategy of other integrated companies appears to be to rationalize the combination of forest resources and processing facilities. Thus, a pulp or paper facility may be divested and replaced if a better fit can be found, either in-country or offshore. An example here is SCA's use of only Nordic long-fiber in a mill, together with exclusive use of imported Brazilian short-fiber pulp.

Summary and Conclusions

To tell the story of globalization in the forest products industry, we first looked at country-level data for wood products production, starting with the raw materials directly harvested from forests (industrial roundwood), as well as the more refined and processed wood products that are derived from these raw materials (sawnwood, pulpwood, wood pulp). While worldwide industrial roundwood production has not changed substantially since 1990, the data reveal shifts in production locations. South America, in particular, has shown the most dramatic production increases. When the focus is limited to sawnwood, our globalization hypothesis is only weakly supported, as North America and Europe have shown the most dramatic sawnwood production increases, although South America also has shown steady increases in sawnwood production. Pulpwood production also has continued to thrive in industrialized regions, particularly in the United States. But here we see production increases throughout the developing world, particularly subtropical regions in South America, as well as in other developing regions such as Eastern and Southern Africa. Finally, when we turn our attention to wood pulp production, the globalization picture comes into sharper focus. Wood pulp production, which traditionally has been far more prevalent in industrialized regions, has been declining or remaining steady in the traditional pulp-producing strongholds (United States, Canada, and Europe), while it has increased dramatically in South America, East Asia, and South and Southeast Asia.

Regarding productive forest plantation area, the data revealed an overall increase throughout the world, as well as some interesting trends in varying tree growth rates among regions. Particularly since 2000, dramatic upsurges have occurred in productive plantations in much of Asia and in parts of Africa and Central America and the Caribbean, compared with more modest increases in the industrialized centers of North America and Europe. The increases also are modest in South America, but this is in the context of a relatively large base established prior to 1990.

Finally, we examined forestry sector employment. We found that, whereas overall forestry employment seems to be decreasing because of increases in labor productivity, forestry sector employment is increasing substantially in many subtropical and tropical areas.

We expect that, whereas many industries already have been significantly reshaped by globalization (e.g., through offshoring and outsourcing), the forestry industry may be at a more nascent stage of globalization, with much of the reshaping of the industry yet to come. Particularly as economic development progresses throughout the world, the forestry industry will continue to evolve and follow in the path taken by other industries that have adapted to a more globalized world and have taken advantage of the features that can generate comparative advantages. Therefore, it is important to monitor trends in the forest products industry as globalization continues to change our world.

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Appendix A: Country List

(Note: for each of the countries listed below, data are available for at least one of the indicators used in this report.)

Eastern and Southern Africa
Angola
Botswana
Comoros
Kenya
Lesotho
Madagascar
Malawi
Mauritius
Mozambique
Reunion
Seychelles
South Africa
Swaziland
Tanzania (United Republic of)
Uganda
Zambia
Zimbabwe

Northern, Western, and Central Africa
Algeria
Benin
Burkina Faso
Burundi
Cameroon
Central African Republic
Chad
Congo
Côte d'Ivoire
Democratic Republic of the Congo
Djibouti
Egypt
Equatorial Guinea
Eritrea
Ethiopia
Gabon
Gambia
Ghana
Guinea
Guinea-Bissau
Liberia
Libyan Arab Jamahiriya

Mali
Mauritania
Morocco
Niger
Nigeria
Rwanda
São Tomé and Príncipe
Senegal
Sierra Leone
Somalia
Sudan
Togo
Tunisia

East Asia
China
Democratic People's Republic of Korea
Japan
Mongolia
Republic of Korea

South and Southeast Asia
Bangladesh
Bhutan
Brunei Darussalam
Cambodia
India
Indonesia
Laos
Malaysia
Myanmar
Nepal
Pakistan
Philippines
Singapore
Sri Lanka
Thailand
Vietnam

Western and Central Asia
Afghanistan
Cyprus
Iran
Iraq
Israel
Jordan
Lebanon
Saudi Arabia
Syrian Arab Republic
Turkey

United Arab Emirates

Europe, excluding Nordic and Soviet countries
Albania
Austria
Belgium
Bosnia and Herzegovina
Bulgaria
Croatia
Czech Republic
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Liechtenstein
Luxembourg
Malta
Netherlands, the
Poland
Portugal
Romania
San Marino
Serbia and Montenegro
Slovakia
Slovenia
Spain
Switzerland
The Former Yugoslav Republic of Macedonia
United Kingdom

Europe, Nordic
Denmark
Finland
Norway
Sweden

USSR/Former USSR
Armenia
Azerbaijan
Belarus
Estonia
Georgia
Kazakhstan
Kyrgyzstan
Latvia
Lithuania
Republic of Moldova

Russian Federation
Tajikistan
Turkmenistan
Ukraine
Uzbekistan

Central America and the Caribbean
Bahamas
Barbados
Belize
Costa Rica
Cuba
Dominica
Dominican Republic
El Salvador
Guadeloupe
Guatemala
Haiti
Honduras
Jamaica
Martinique
Mexico
Nicaragua
Panama
Trinidad and Tobago

North America—USA
United States of America

North America—Canada
Canada

Oceania
Australia
Cook Islands
Fiji
New Caledonia
New Zealand
Niue
Papua New Guinea
Samoa
Solomon Islands
Tonga
Vanuatu

South America
Argentina
Bolivia
Brazil
Chile

Colombia
Ecuador
French Guiana
Guyana
Paraguay
Peru
Suriname
Uruguay
Venezuela (Bolivian Republic of)

Appendix B: Interviews undertaken by Roger A. Sedjo

Doug Parsonsons, president, Porya North America, February 6, 2006, Washington, DC.

Lynn Michaelus, chief economist, Cassie Phillips, vice president, and others, Weyerhaeuser, Federal Way, Washington, July 25, 2006,

Bjorn Hagglund, former vice chief executive officer, Stora-Enso, September 15, 2006, Bergs Gård, Sweden.

Richard Nilson, financial analyst, SEB Enskilda, Stockholm, and Anders Luthbom, vice president, Business Intelligence, Svenska Cellulosa, Aktiebolaget, September 16, 2006, Stockholm.

Seppo Suuronen, vice president, Business Intelligence, and Ikka Kartvaara, senior vice president, Corporate Support and Research and Development, Stora-Enso, September 18, 2006, Helsinki.

Jan Heino, ADG Forestry, September 22, 2006, FAO Rome.

Kit Prinz (OECD Geneva);

Patrick Durst (FAO Senior Forestry Office for Asia)

and Carlos Marx R. Carneiro (Oficial

Principal Forestal, FAO, Santiago, Chile), all interviewed 12 September, 2006, FAO, Rome.

Kraft, James, vice president, general counsel, and Robert Jirsa, Plum Creek, October 4, 2005, Seattle, Washington.

Appendix C: Interview Document

Forest Industry Globalization

As is the case with many other industries, the forest industry has undergone profound changes in recent years. For globalization, we need:

Free Trade: Allows for the unrestricted international flow of goods and services.

Globalization: Allows for relatively free international flow of investments, capital goods, and technologies.

Characteristics: Our hypothesis is that these changes have been brought about in large part by new technologies, particularly tree improvement in forest plantations, which allow competitive forces to move toward the globalization of the forest industry. The forest industry, as a natural resource industry, begins its production with the resource (at the forest).

Relatively free flow of investments, capital, new technologies.

This would move rather easily into regions where they are expected to be particularly productive, especially investments in plantations.

Offshore outsourcing is closely associated with globalization.

In forestry, this process takes on an additional dimension in which the basic resource itself, the forest, can be relocated to take advantage of cost advantages in particular regions.

Additional changes have been driven by modern biotechnology, which has dramatically increased overall forest productivity, as well as the variety of areas in which productive forests can be grown.

Question: Is globalization occurring in the forest products industry? Does it fit the description above?

Question: Would globalization suggest that we would observe increasing multinational ownership of forest industry assets? Or is this a separate phenomenon?

Old Model:

Integrated firms relying on natural forest (old growth and managed), processing locally and trading on local, regional, and international markets.

New Model (United States):

Firms divesting of forestlands to other ownerships, increased specialization within a product market, and consolidation across product markets. Also, more offshore ownership of forests by U.S. firms.

Question: Do we observe U.S. and/or foreign firms *both* divesting domestically and integrating or expanding internationally?

Recent Changes:

- Shift from the West to the South (United States)
- Shift from natural forests to planted forests
- Large investments in tree improvement and tree biotechnology
- High levels of tree planting
- Increasing divestiture of timberlands
- Consolidation via mergers and buyouts
- Shift from integrated firms to separate specialized firms
- Increasing offshore investments

Question: What are the limits to globalization in the forest products industry?

Question: How might biomass energy, and particularly biorefinery-pulpmills, impact the future of the forest products industry and globalization?

Globalization's Impacts on the Forest Products Industry

Appendix D: Figures 1-25

Figure 1: Industrial Roundwood Removals by Region, 1990-2005

(Source: FAO Country Profiles, http://www.fao.org/forestry/foris/webview/forestry2/index.jsp?siteId=5081&sitetreeId=18927&langId=1&geoId=0)

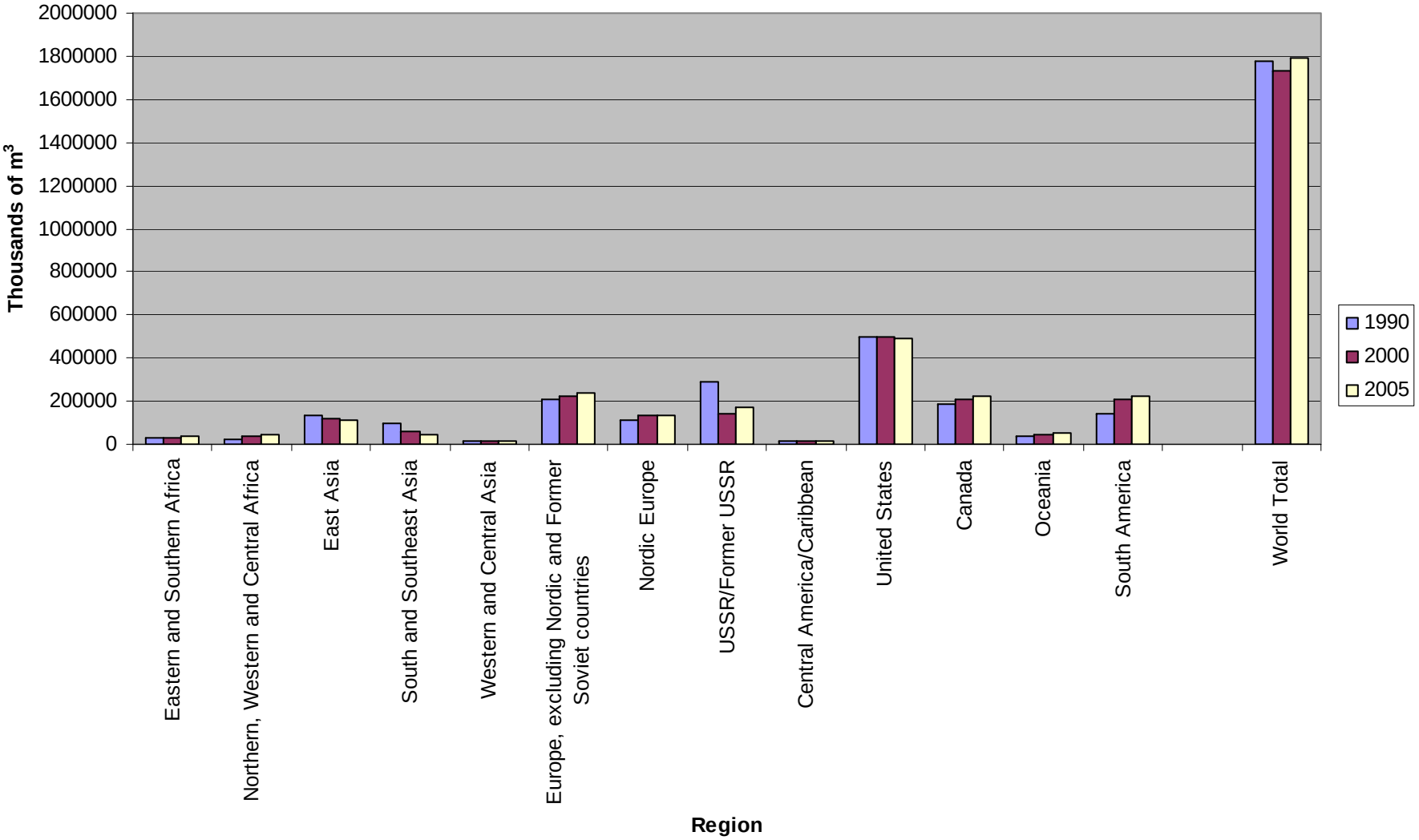


Figure 2: Industrial Roundwood Removals, % of World Total by Region 1990-2005
(Source: FAO Country Profiles,
http://www.fao.org/forestry/foris/webview/forestry2/index.jsp?siteId=5081&sitetreeId=18927&langId=1&geoId=0)

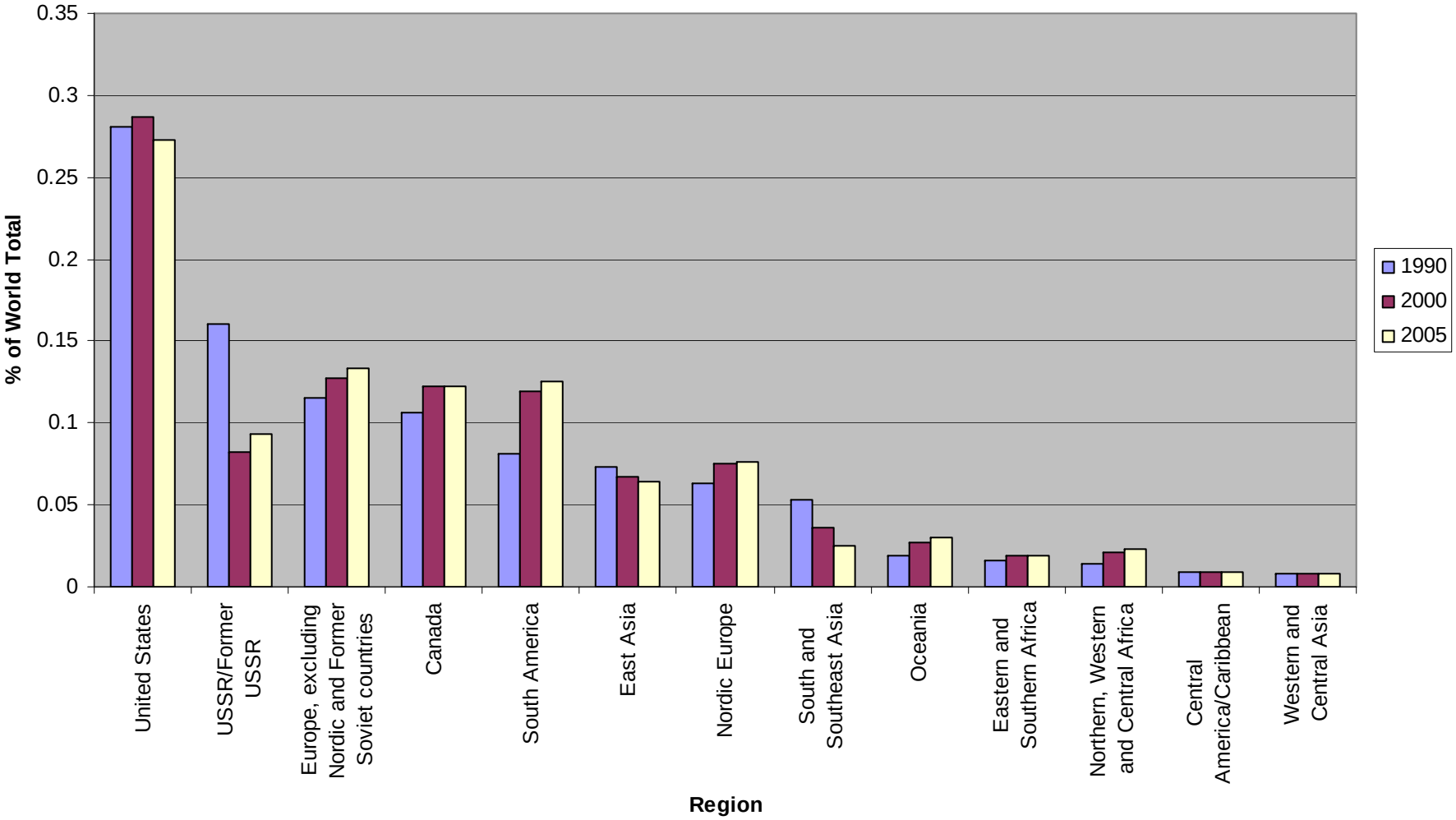


Figure 3: Industrial Roundwood Production by Region, 1980-2004
(Source: FAOStat Forest Products Database)

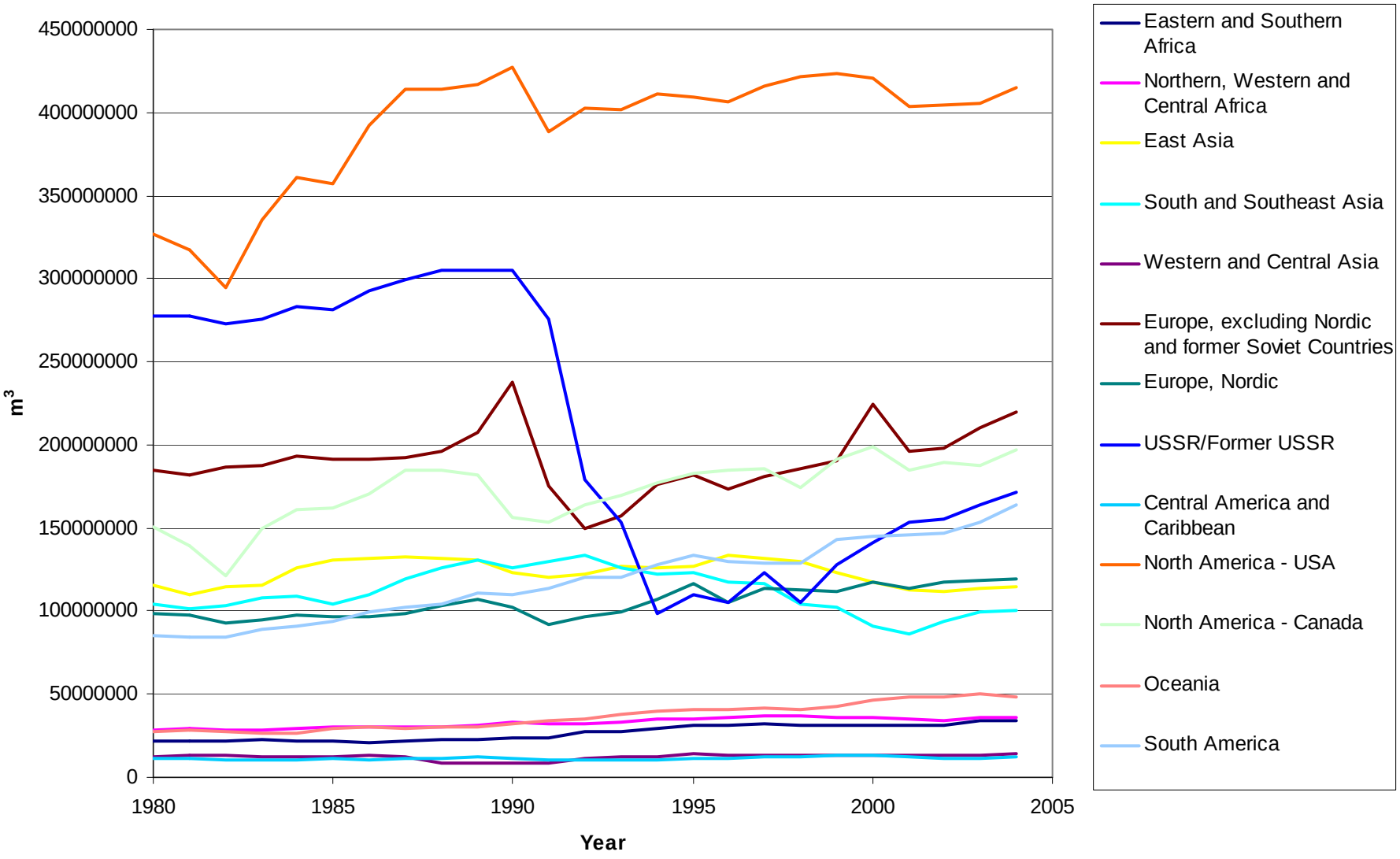


Figure 4: Total Industrial Roundwood Production, 1980-2004
(Source: FAOStat Forest Products Database)

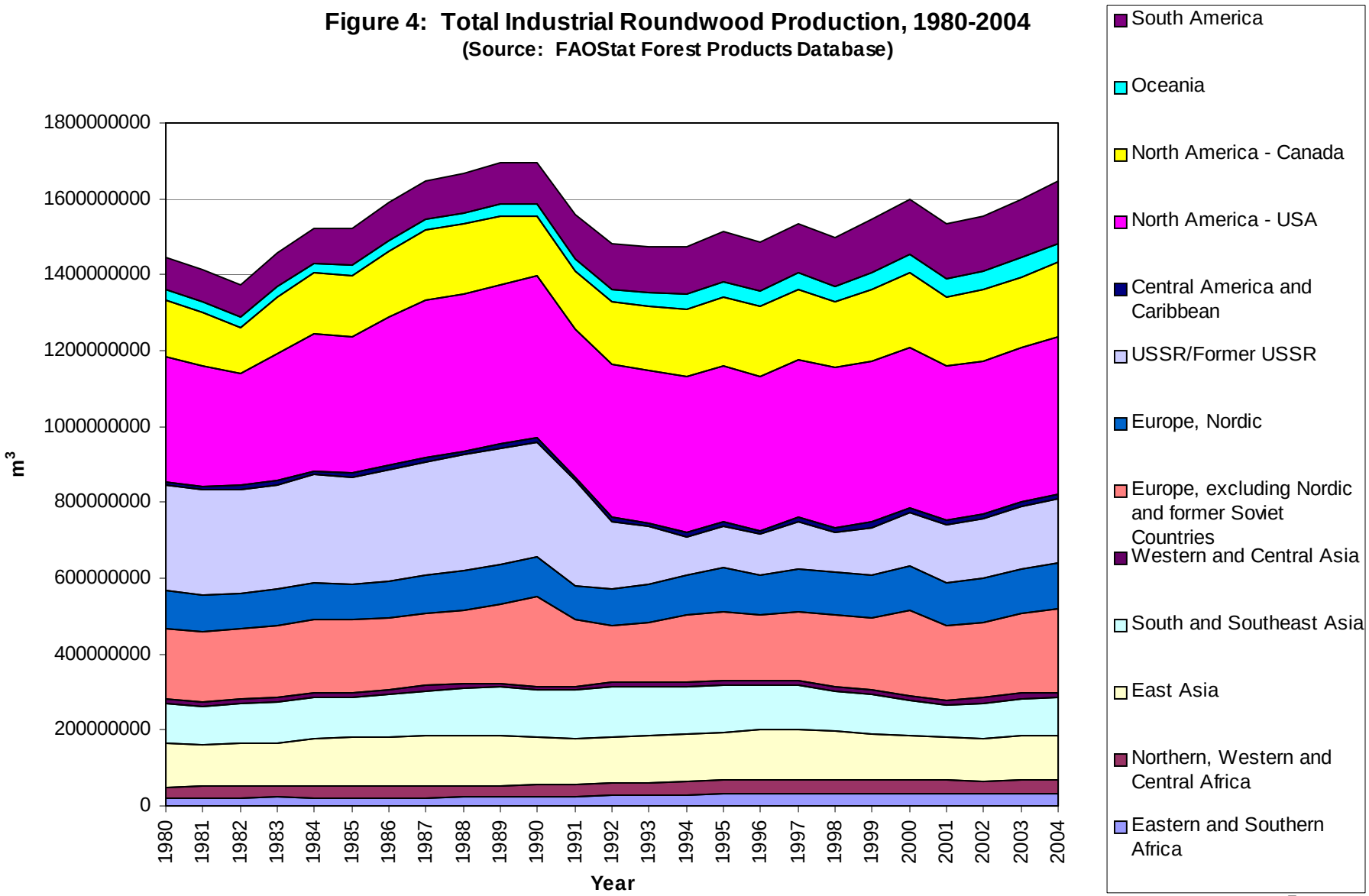


Figure 5: Industrial Roundwood Production - Regional % of Total World Production, 1980-2004
(Source: FAOStat Forest Products Database)

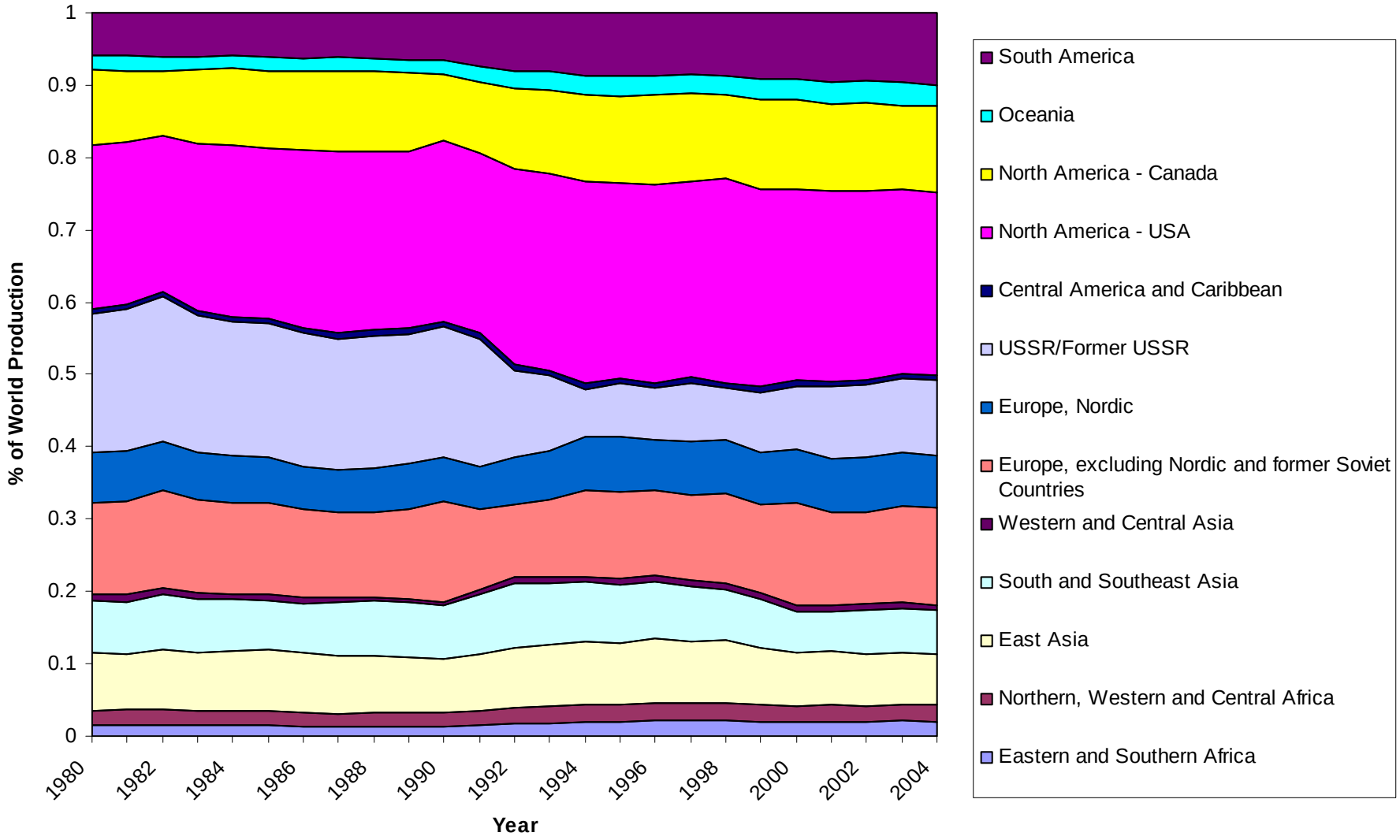


Figure 6: Regional Industrial Roundwood Production, 1980-2004 (Largest Producing Regions Excluded)

(Source: FAOStat Forest Products Database)

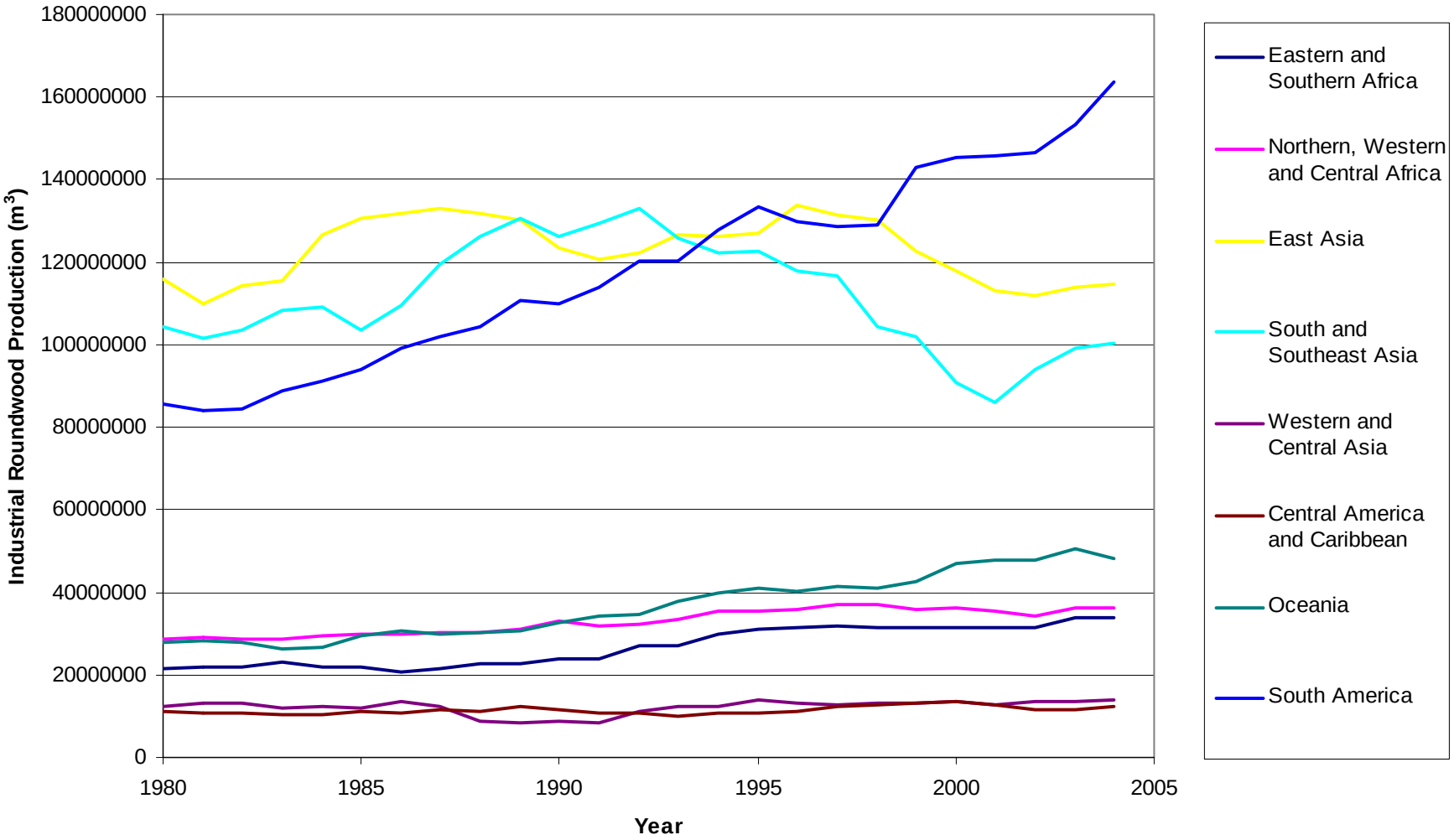


Figure 7: Industrial Roundwood Production Percentage of World Production, 1980-2004
(Largest Producing Regions Excluded)
(Source: FAOStat Forest Products Database)

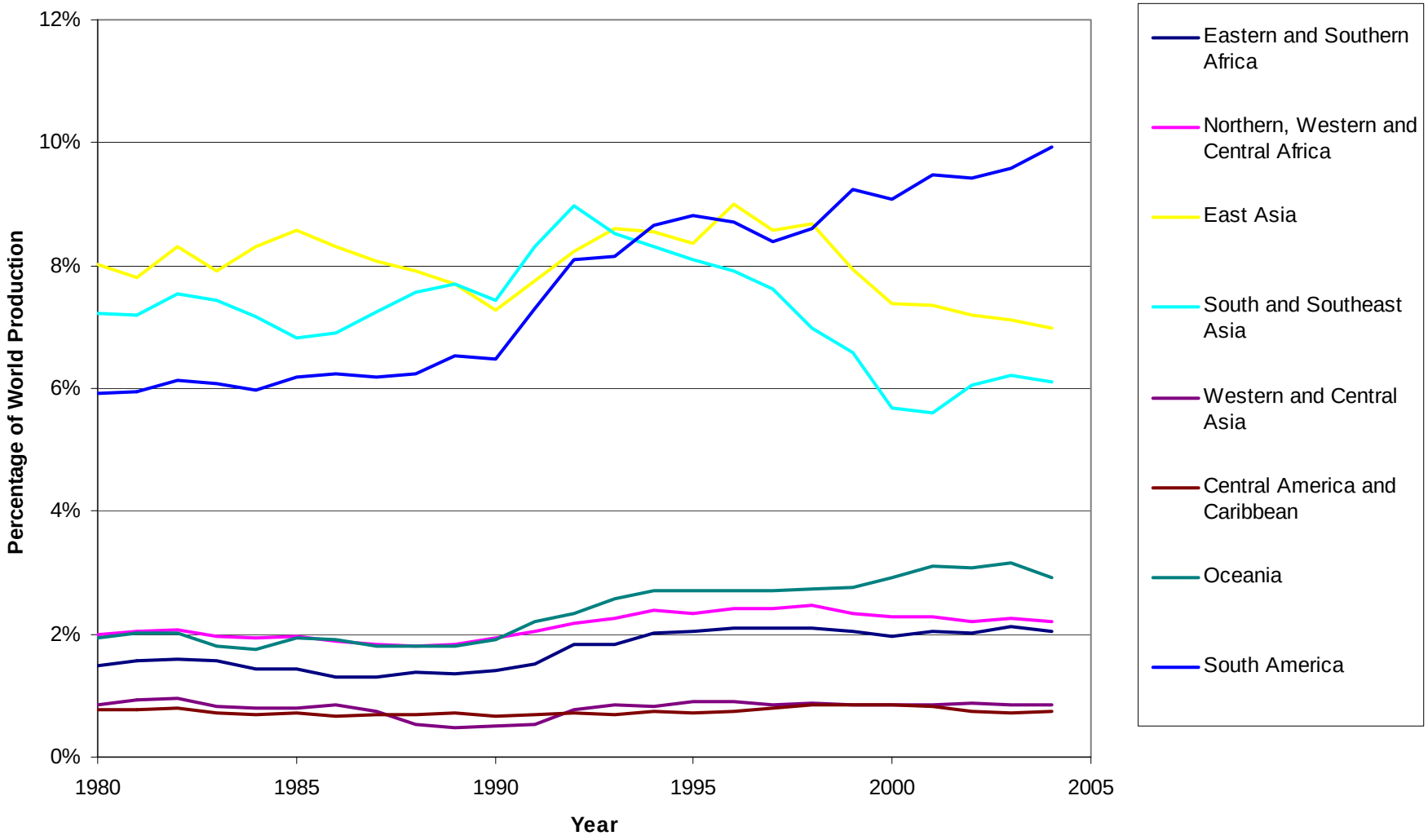


Figure 8: Regional Sawnwood Production, 1980-2004
(Source: FAOStat Forest Products Database)

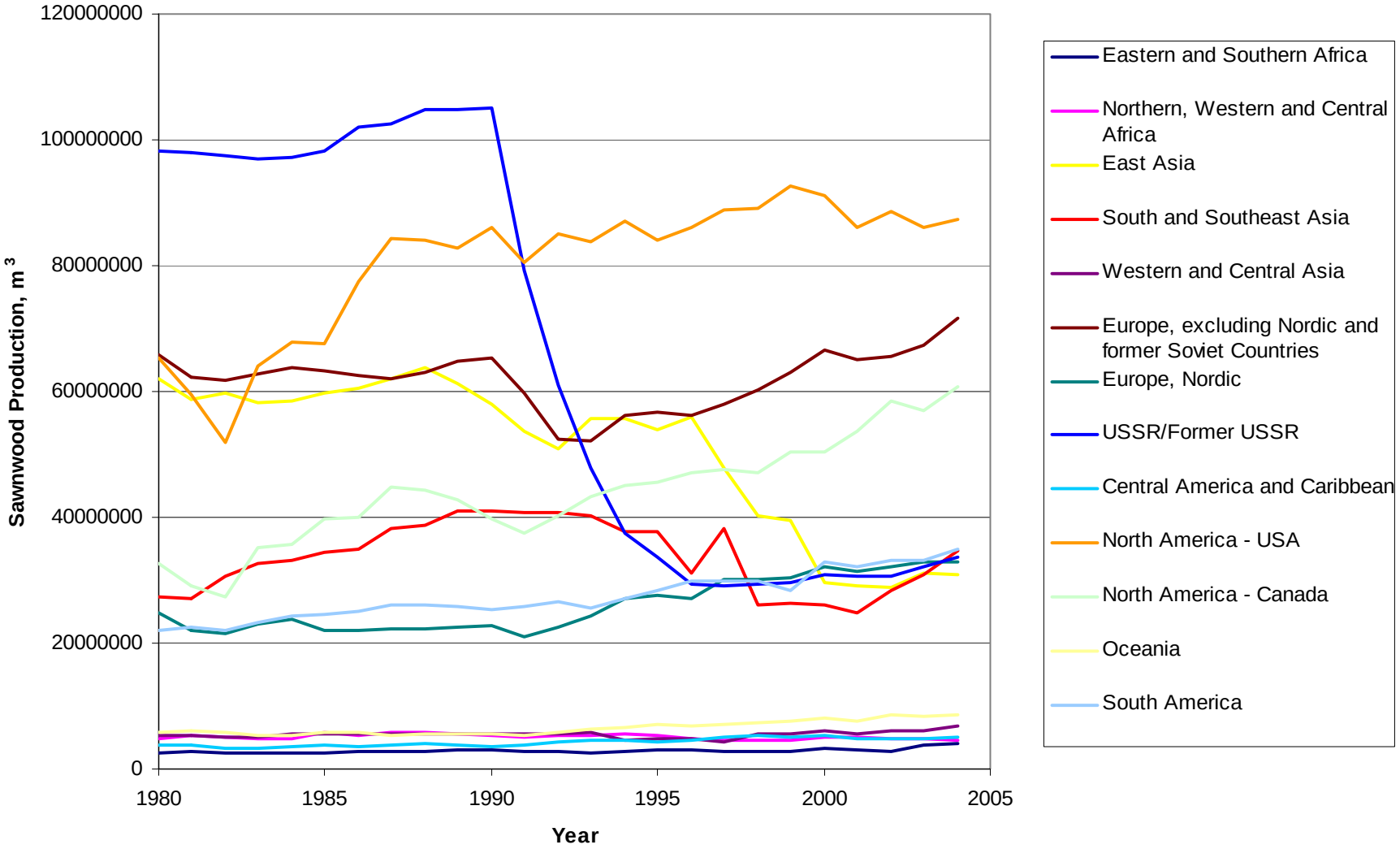


Figure 9: Regional Sawnwood Production, Proportion of World Production, 1980-2004
(Source: FAOStat Forest Products Database)

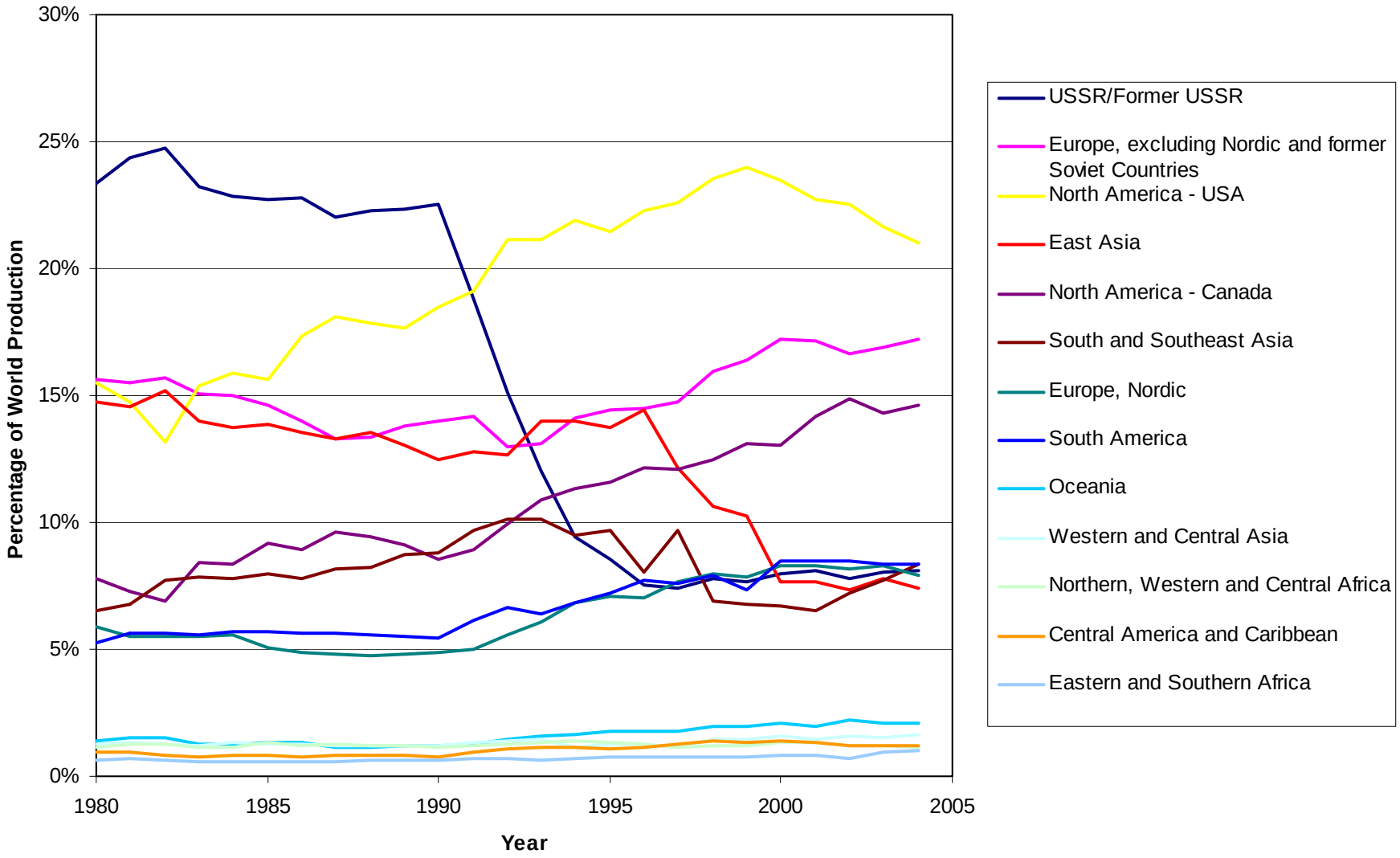


Figure 10: Regional Sawnwood Production, Proportion of World Production, 1980-2004
(Source: FAOStat Forest Products Database)

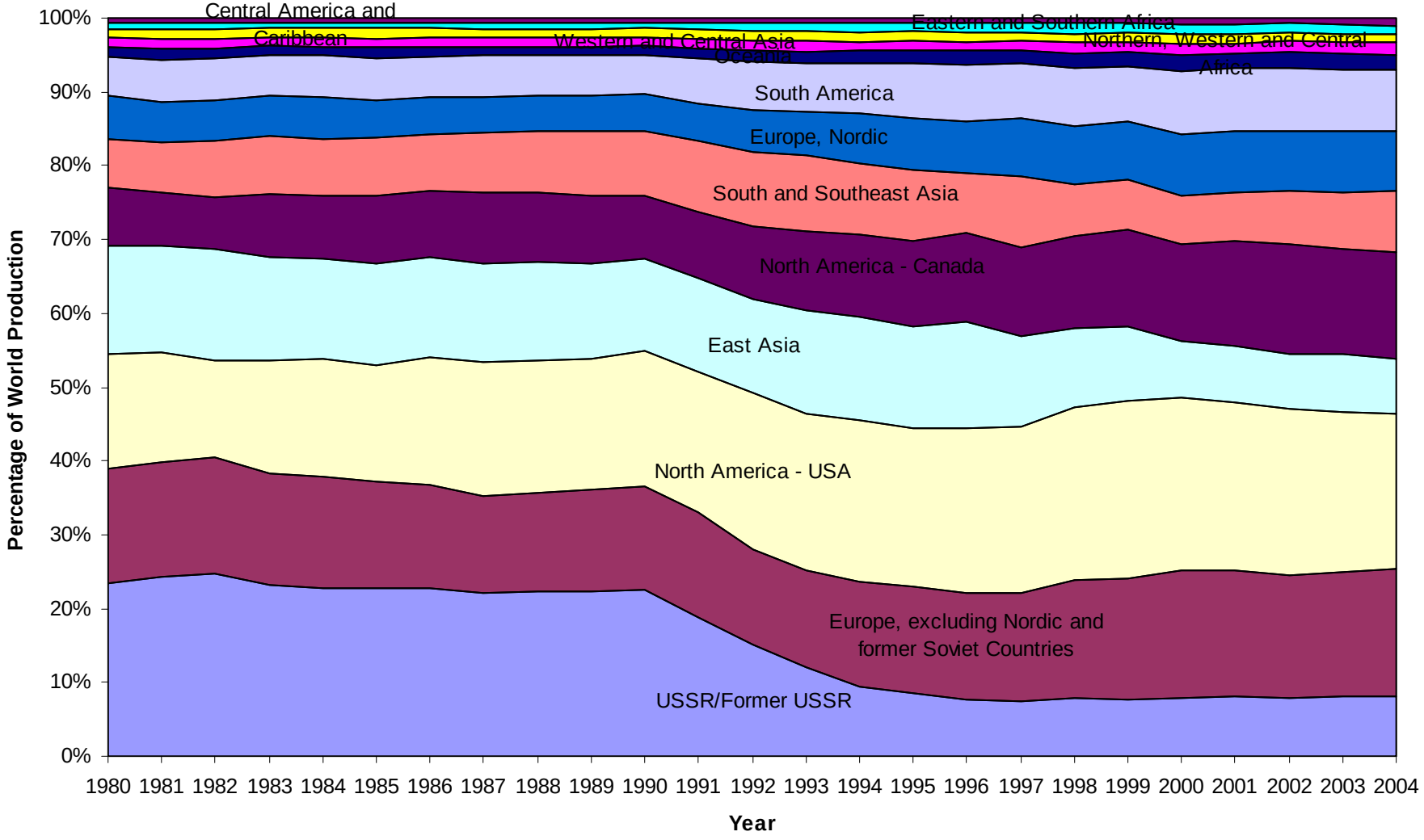


Figure 11: Regional Sawnwood Production, 1980-2004 (Largest Producing Regions Excluded
(Source: FAOStat Forest Products Database)

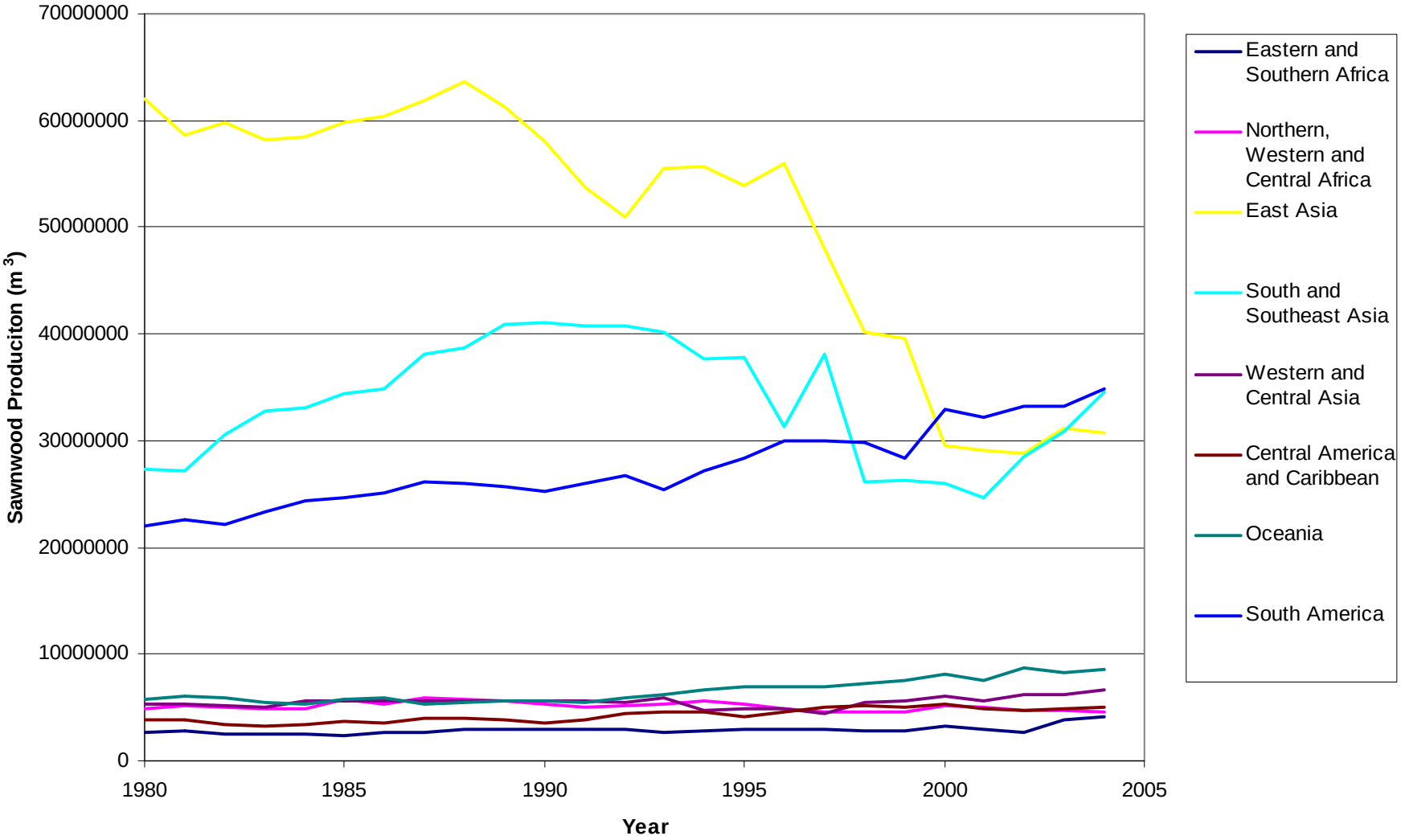


Figure 12: Regional Sawnwood Production Percentage of World Production, 1980-2004
(Largest Producing Regions Excluded)
(Source: FAOStat Forest Products Database)

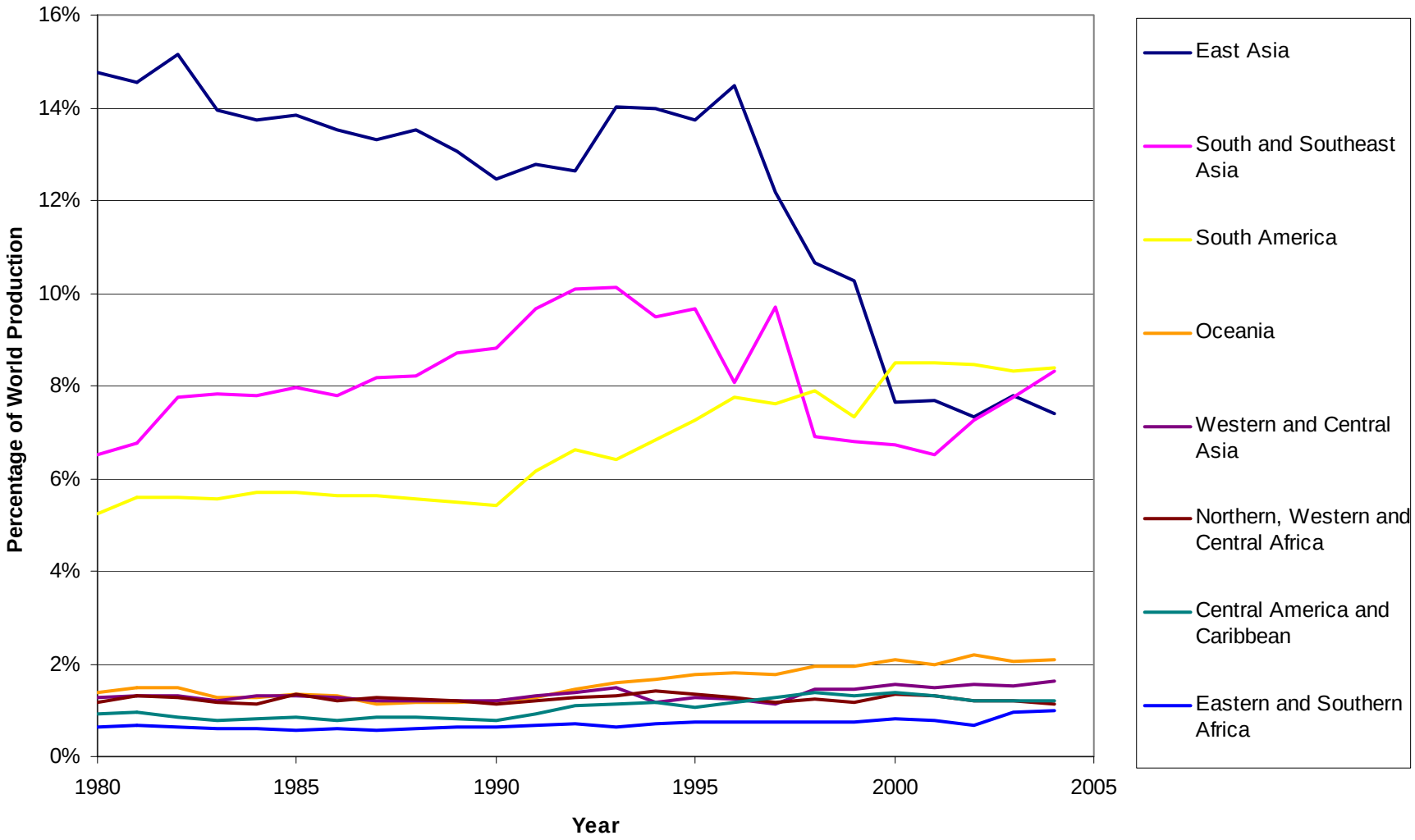


Figure 13: Regional Pulpwood Production, 1980-2004
(Source: FAOStat Forest Products Database)

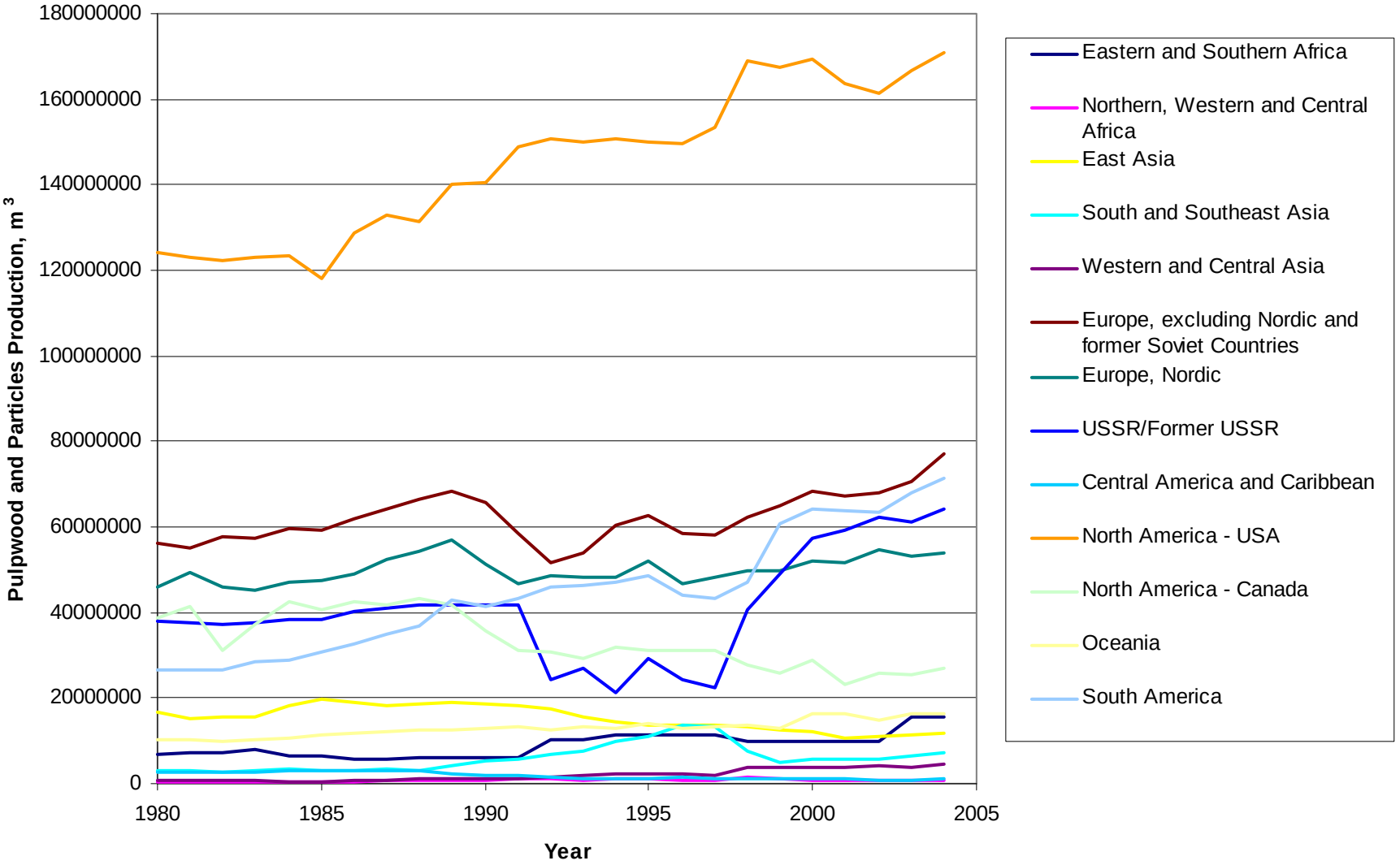


Figure 14: Regional Pulpwood Production, Proportion of World Total, 1980-2004
(Source: FAOStat Forest Products Database)

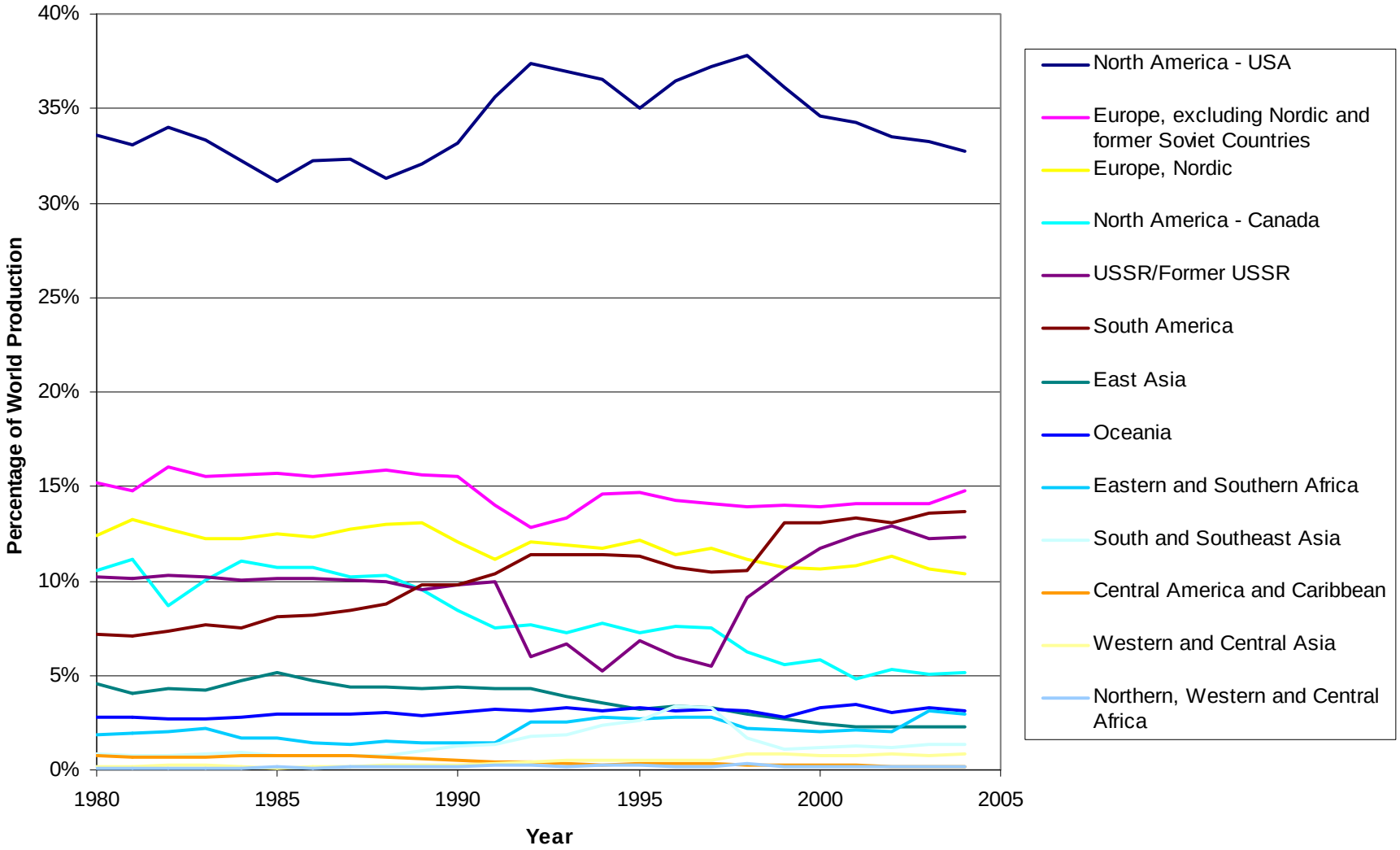


Figure 15: Regional Pulpwood Production, Proportion of World Production, 1980-2004
(Source: FAOStat Forest Products Database)

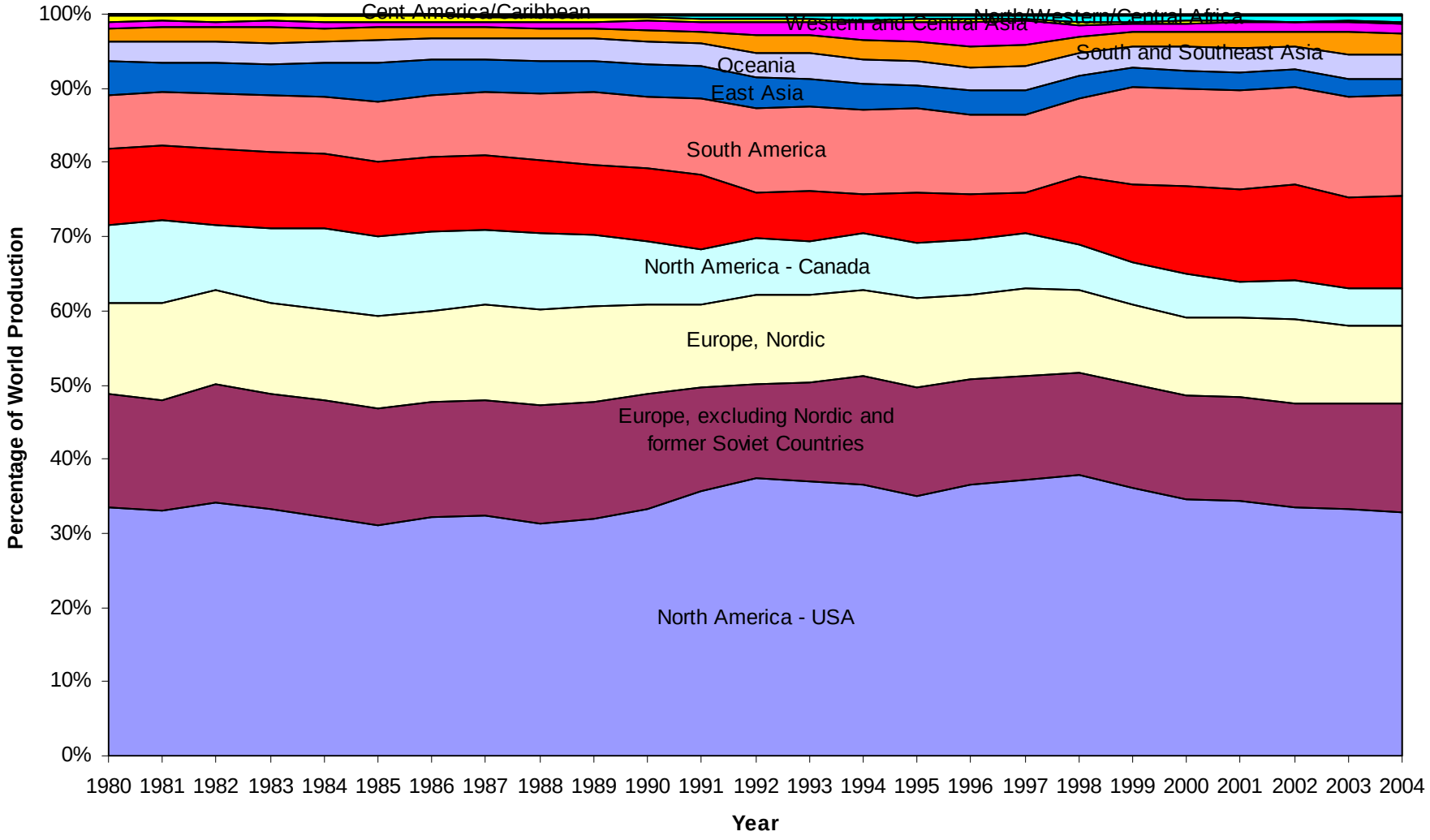


Figure 16: Regional Pulpwood Production, 1980-2004 (Largest Producing Regions Excluded)
(Source: FAOStat Forest Products Database)

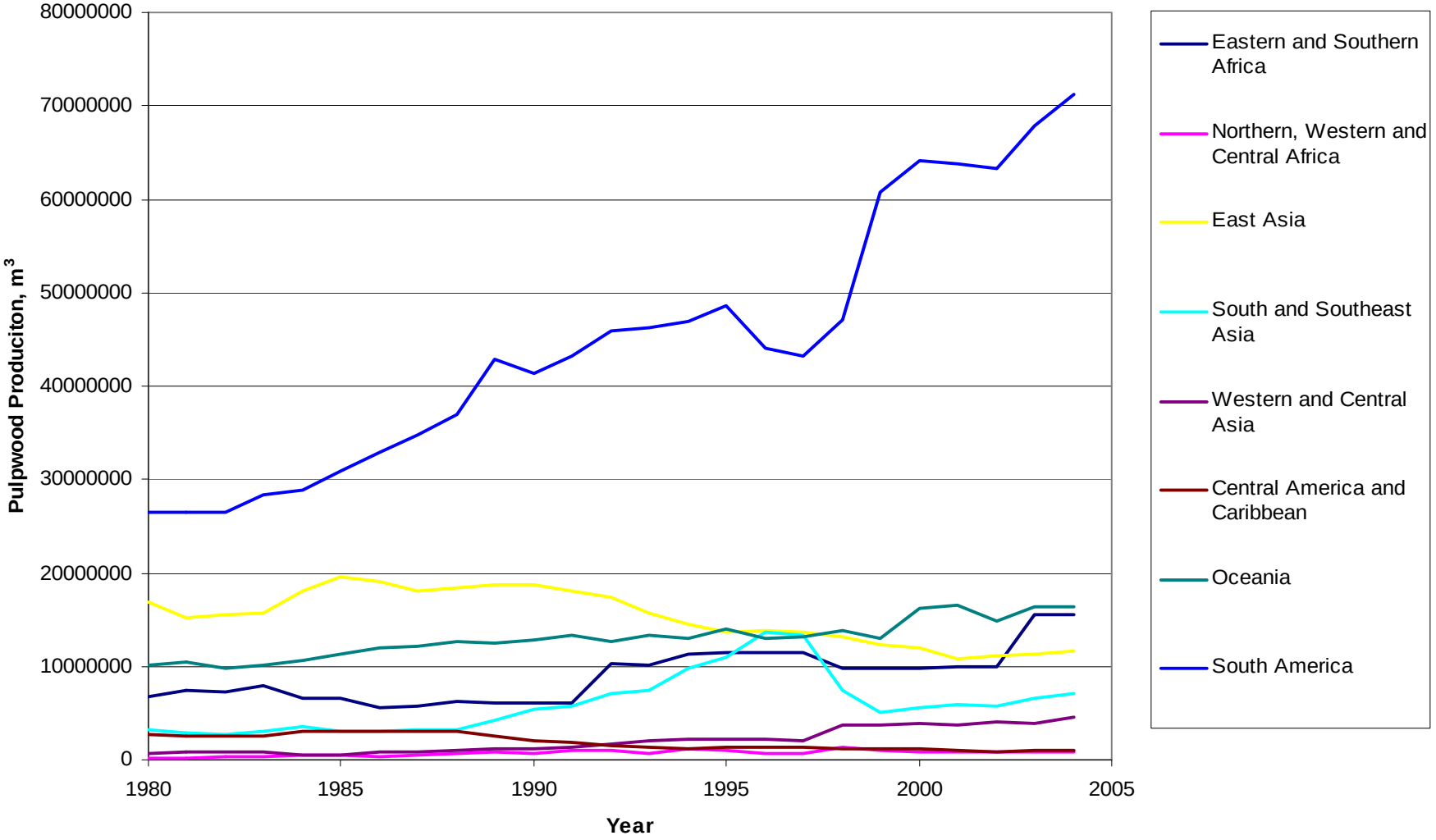


Figure 17: Regional Pulpwood Production Percentage of World Production, 1980-2004
(Largest Producing Regions Excluded)
(Source: FAOStat Forest Products Database)

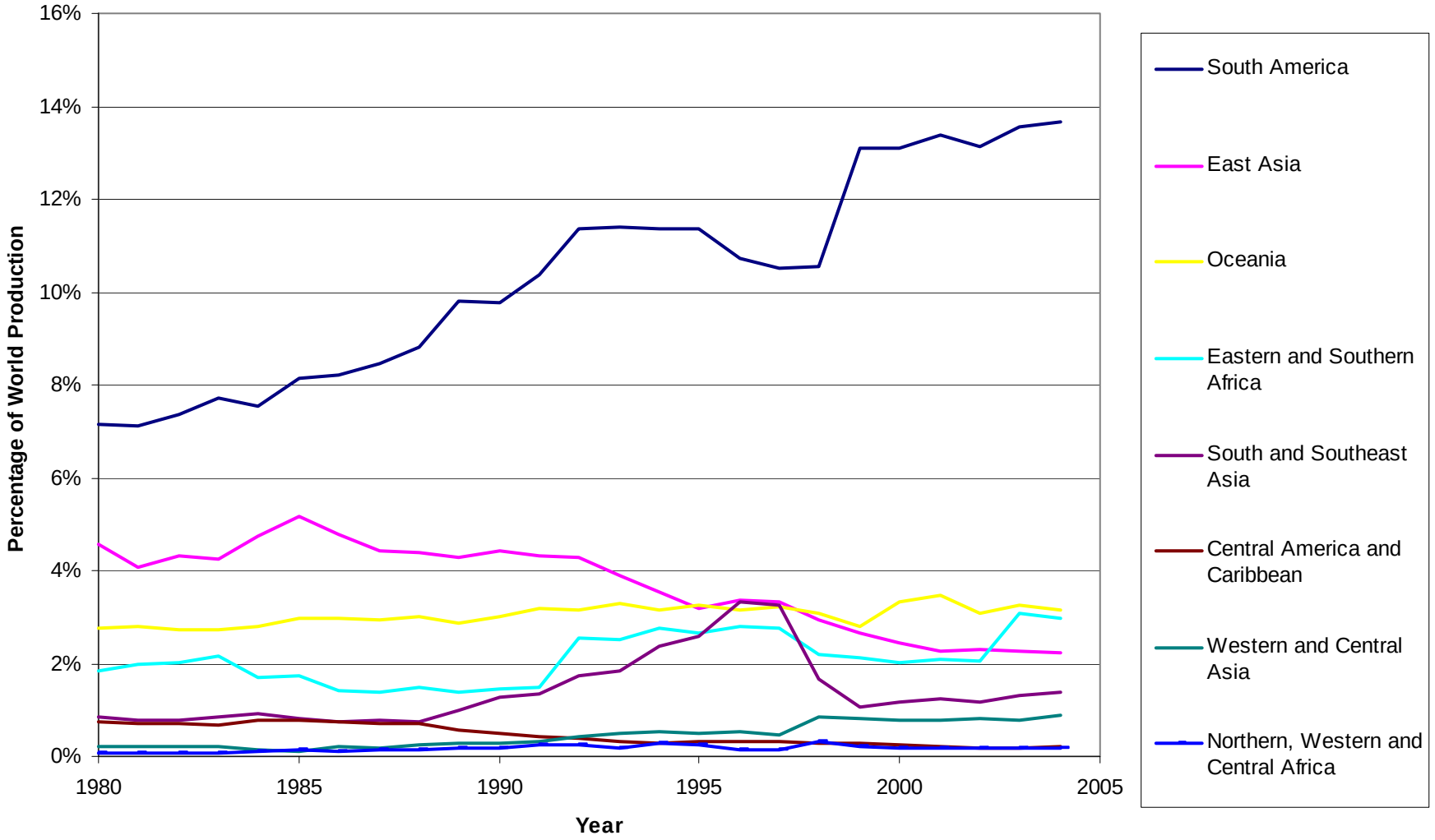


Figure 18: Regional Pulp Production, 1980-2004
(Source: FAOStat Forest Products Database)

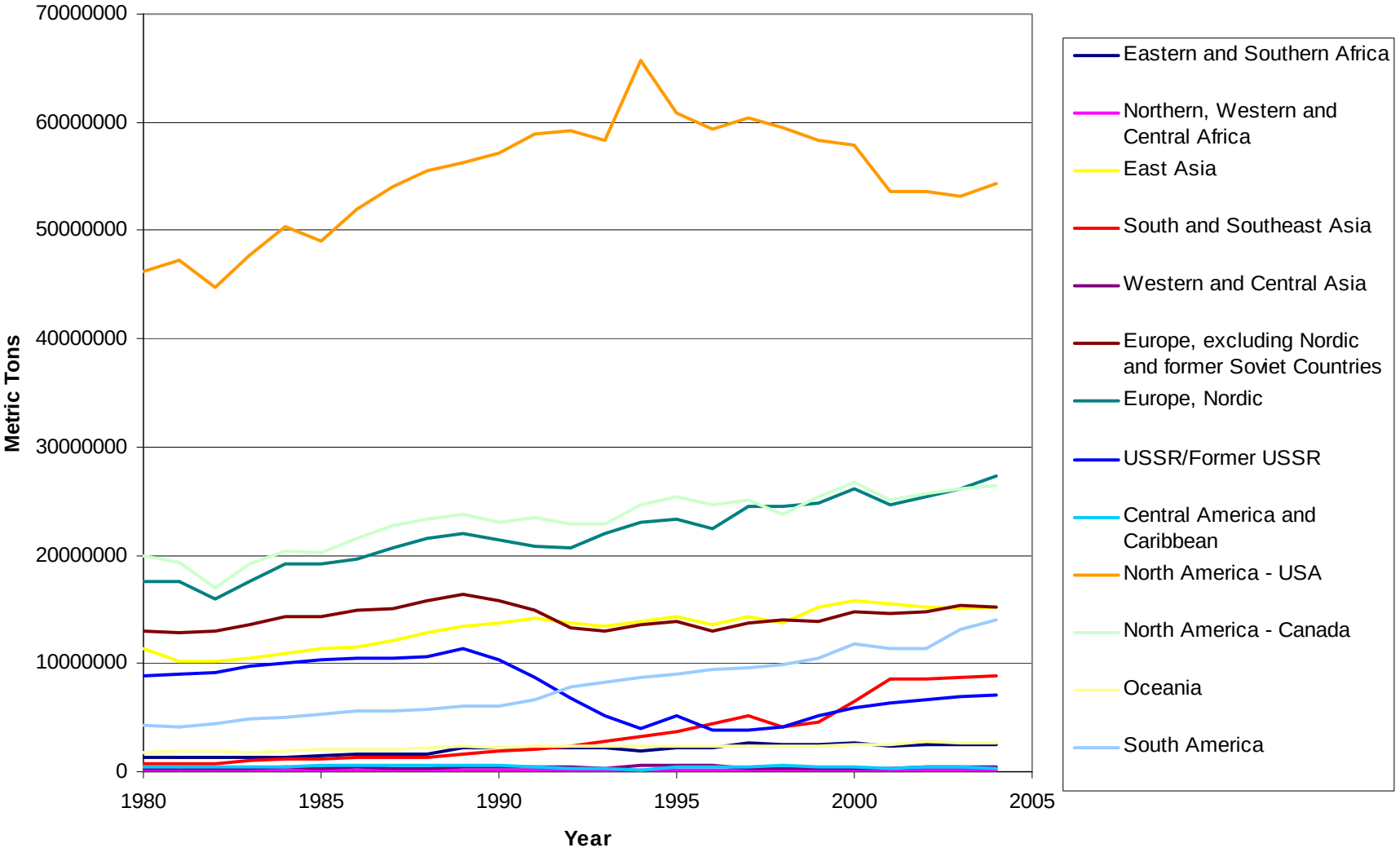


Figure 19: Regional Pulp Production, Proportion of World Total, 1980-2004
(Source: FAOStat Forest Products Database)

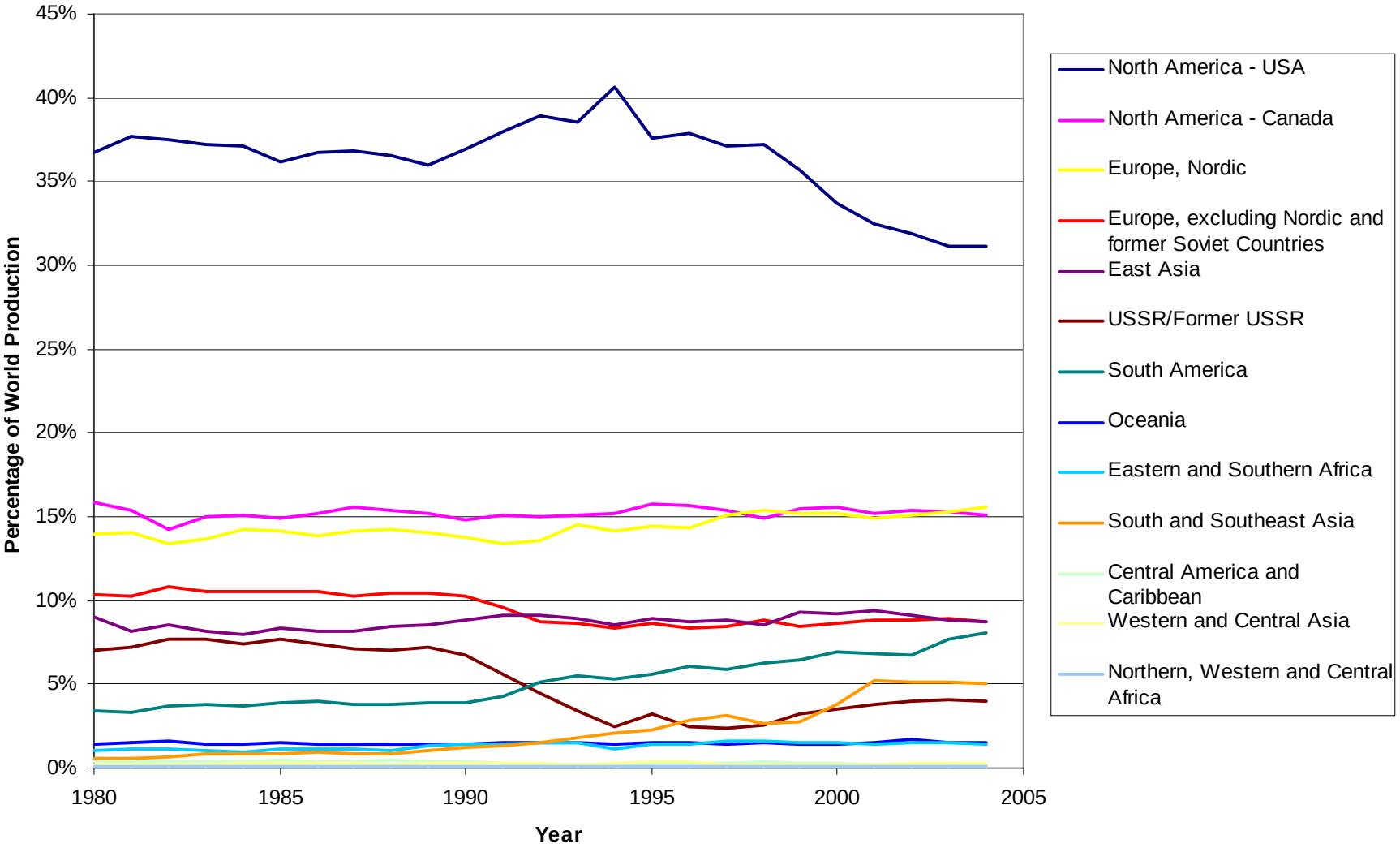


Figure 20: Regional Pulp Production, 1980-2004 (Largest producing regions excluded)
(Source: FAOStat Forest Products Database)

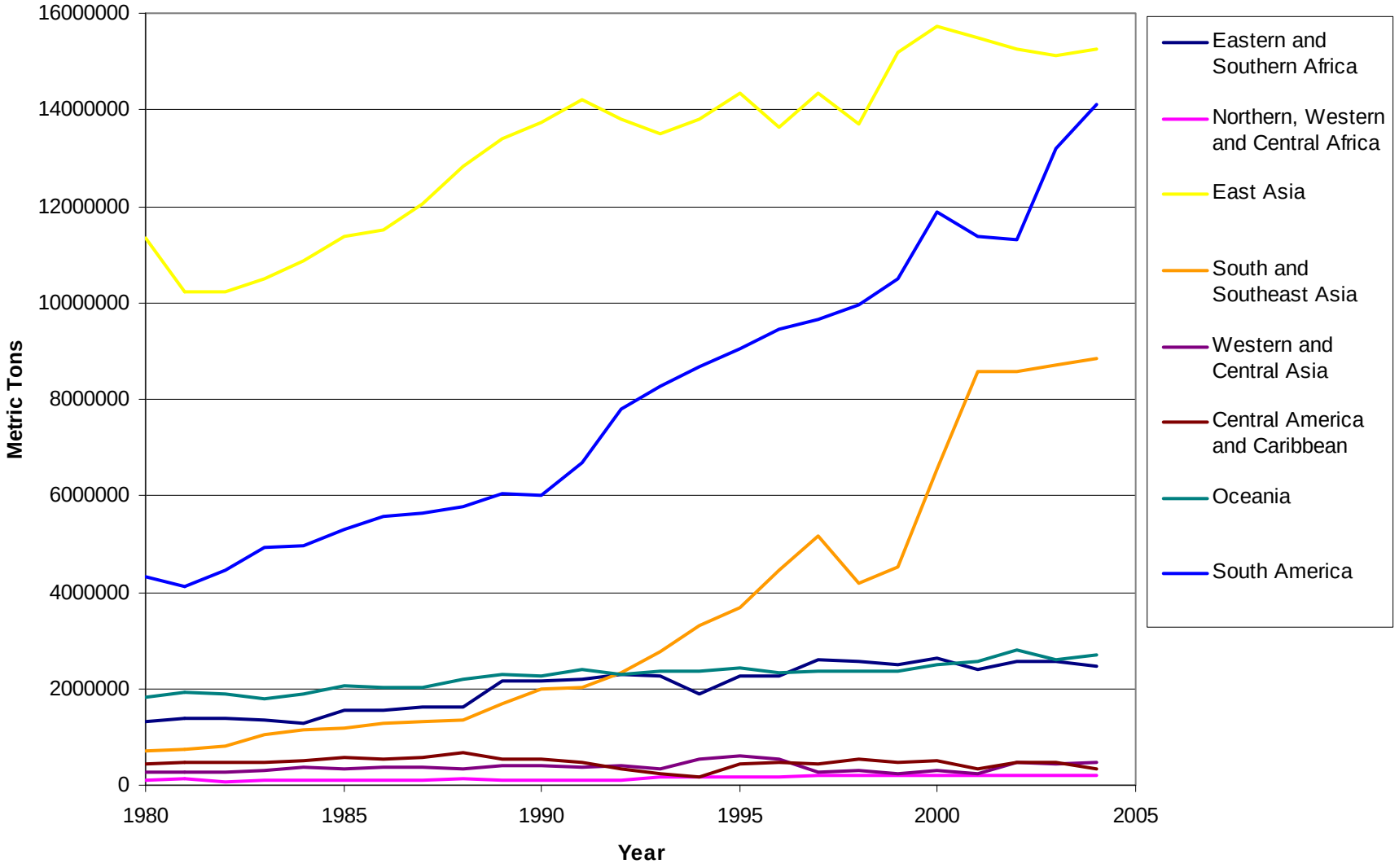


Figure 21: Regional Pulp Production Percentage of World Production, 1980-2004 (Largest Producing Regions Excluded)
(Source: FAOStat Forest Products Database)

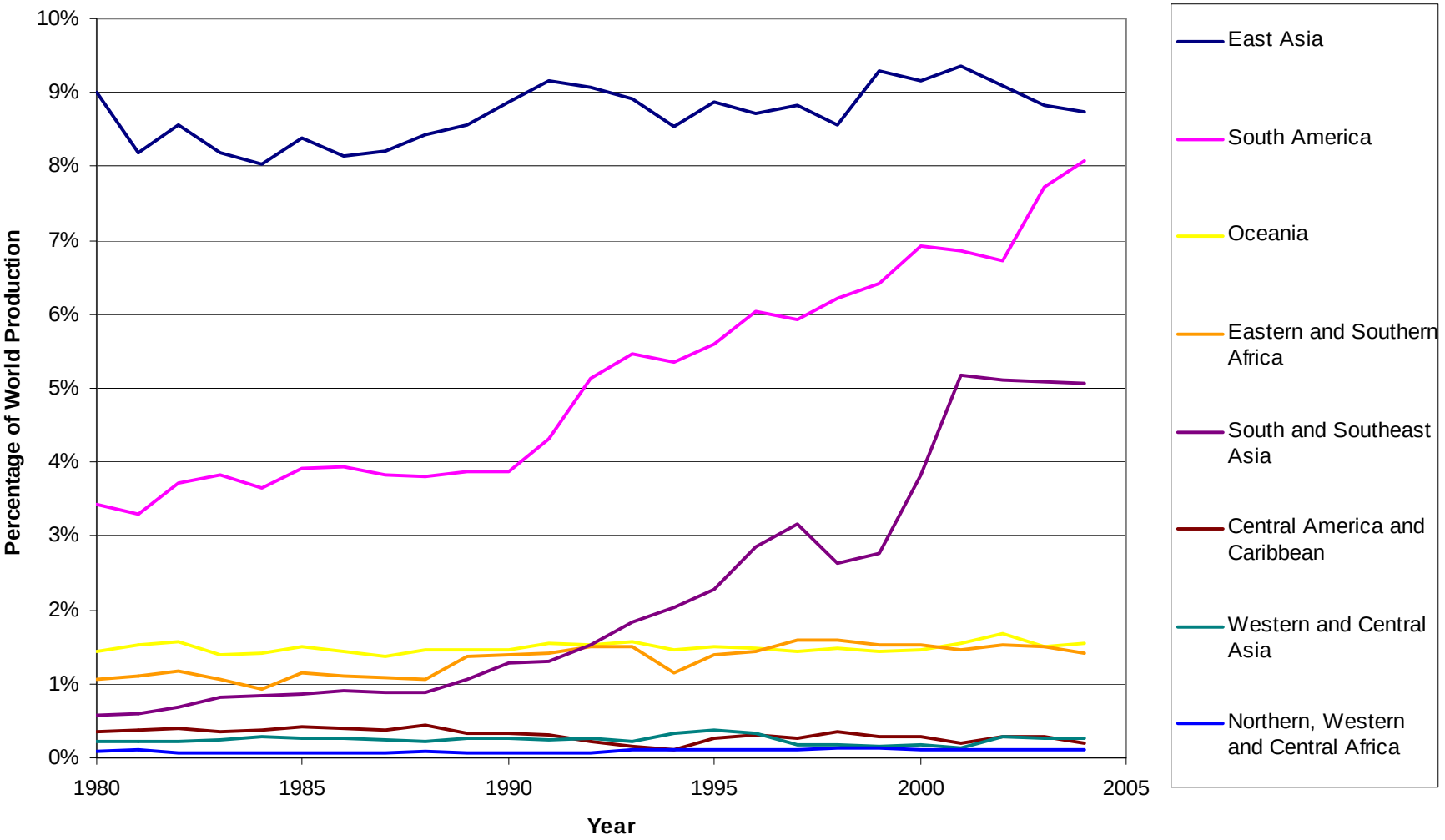
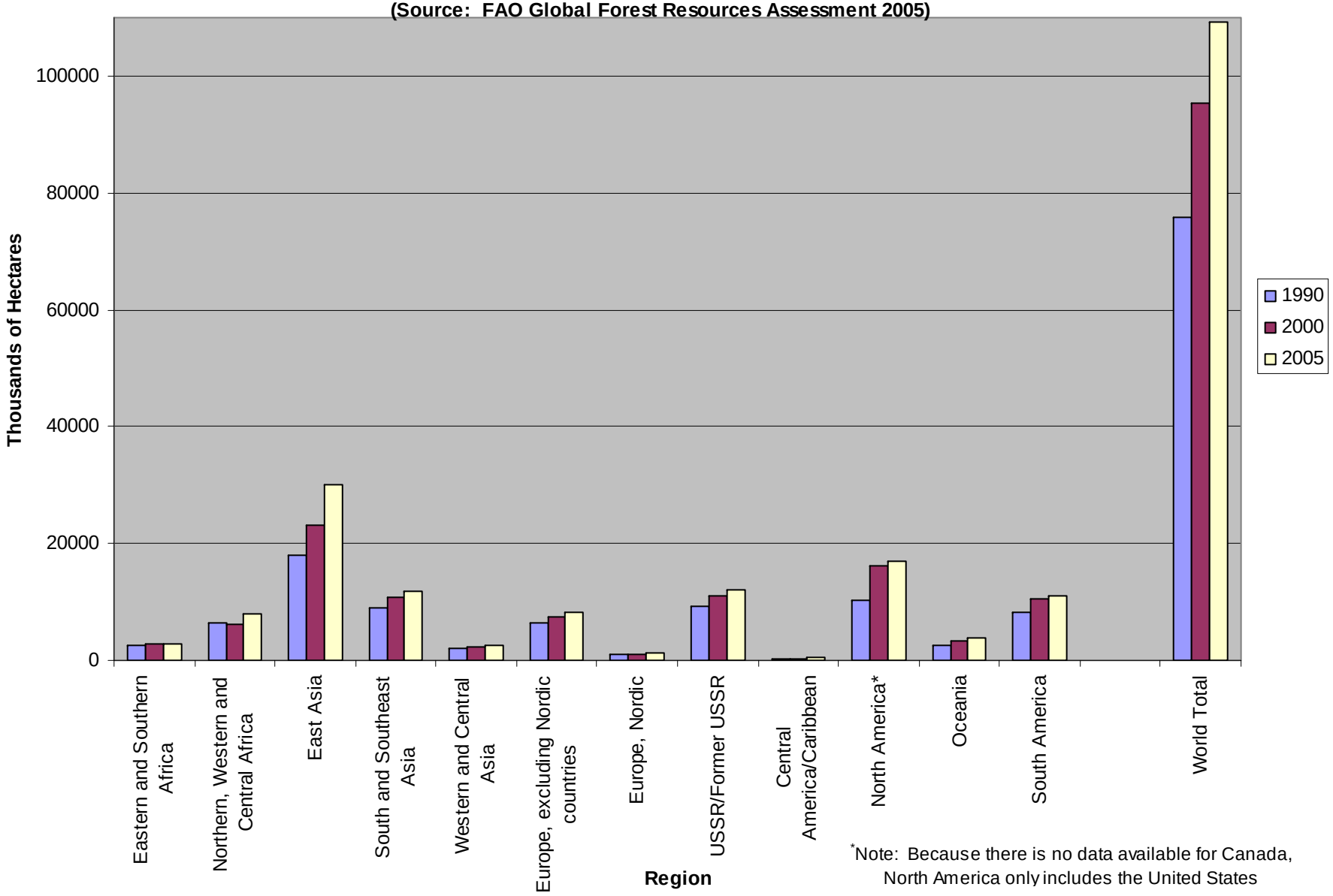


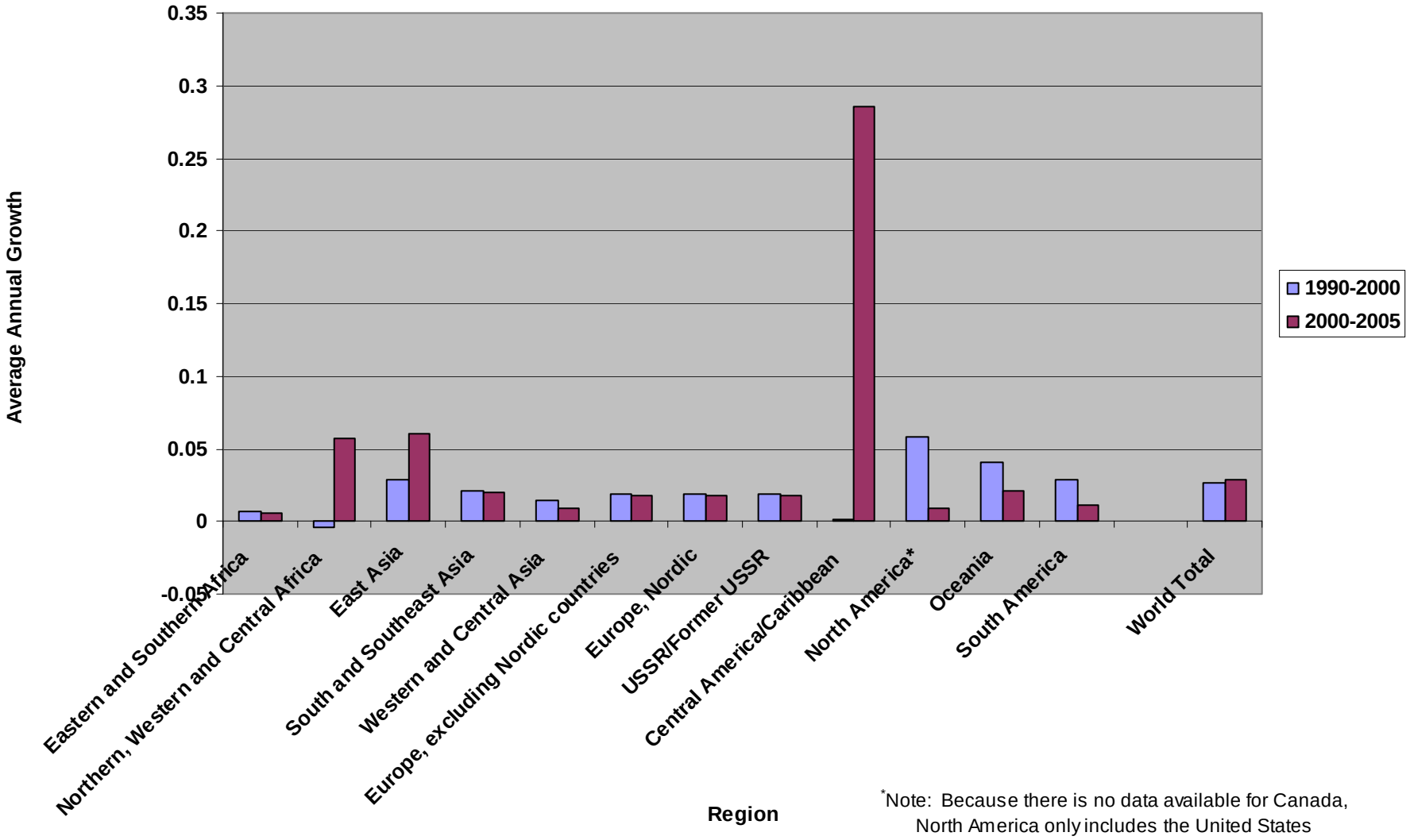
Figure 22: Forest Productive Plantation Area by Region 1990-2005

(Source: FAO Global Forest Resources Assessment 2005)



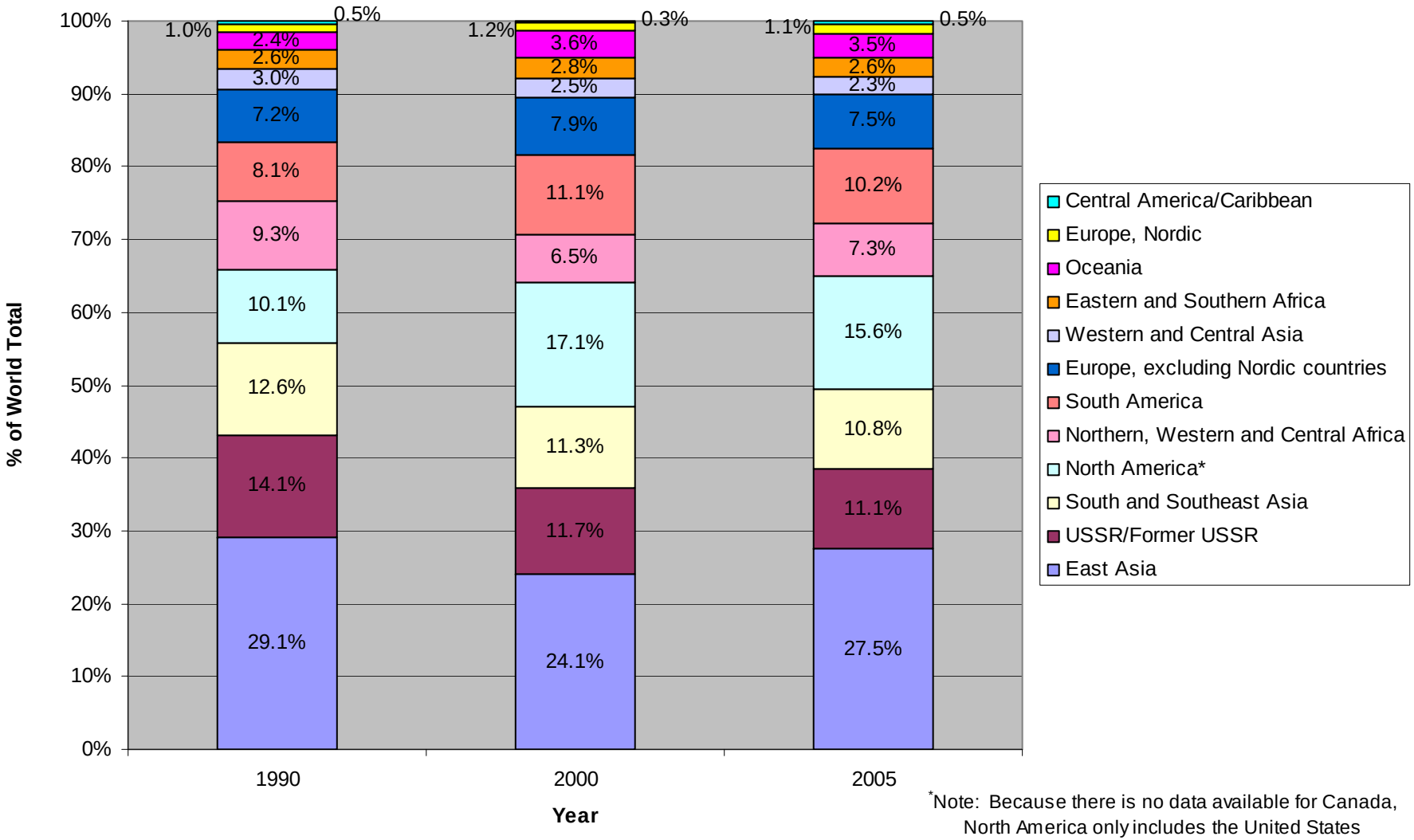
*Note: Because there is no data available for Canada, North America only includes the United States

Figure 23: Average Annual Growth in Plantations, 1990-2005
(Source: FAO Global Forest Resources Assessment 2005)



*Note: Because there is no data available for Canada, North America only includes the United States

Figure 24: Forest Plantations by Region, % of World Total, 1990-2005
(Source: FAO Global Forest Resources Assessment 2005)



*Note: Because there is no data available for Canada, North America only includes the United States

Figure 25: Number of People Employed in Forestry by Region, 1990 - 2000
(Source: FAO Global Forest Resources Assessment 2005)