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**Soviet Timber Resources and Utilization:
An Interpretation of the
1988 National Inventory**

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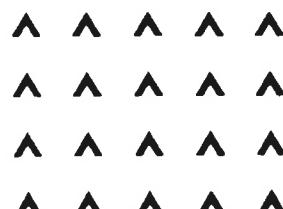
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**SOVIET TIMBER RESOURCES AND
UTILIZATION: AN INTERPRETATION
OF THE 1988 NATIONAL INVENTORY**

**CHARLES A. BACKMAN
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Press Release

A recently released study of the forest resources of the Soviet Union and the export potential has revealed that the national timber base, while dominating the global timber supply picture, cannot be expected to support increased exports to either European or Asian markets in the short to medium term. A chaotic distribution system, uncertain replacement of existing domestic capital stock, environmental concerns further restricting timber supply, a huge and largely unfulfilled domestic appetite for forest products, and low valued species located in a hostile environment all conspire to restrict the likelihood of large positive changes in export volumes.

The forest resources of the European USSR are almost completely utilized. While harvest levels from the coniferous resource are expected to decline due to industrial pollution and past forest management practices, the hitherto unutilized deciduous resource will compensate for this. Thus, the harvest from the European USSR is expected to be unchanged, although the share of deciduous species will rise.

Current log export levels to Europe, however, may be in doubt. European USSR imports a higher volume of logs from the Asian USSR than it exports to the west. Under current economic reforms, the timber surplus regions in Asian USSR may not be as sanguine about substituting for fibre which is exported for hard currency. Thus, internal exports hitherto to European USSR may be redirected to external Asian markets.

Increased harvest from the forest resources of Asian USSR is dependent in large measure on foreign technology and large investments in infrastructural development. While the Asian USSR supports a wealth of forest inventory, a large part is presently unavailable due to economic and environmental considerations. Substantial volumes are available, but only with huge investments in infrastructure. Incremental volumes are possible with importation of western technology to permit increased utilization of the deciduous resource and harvest of forests from steeper slopes. While hitherto exports to the rest of the Soviet Union may be directed for external export to Asian markets, inherent difficulties with the existing infrastructure may work against a substantial portion being available for export.

In the medium to long-term, a huge and largely unsatisfied domestic demand for forest products throughout the Soviet Union could possibly absorb a significant share of the potentially available timber resource. While great strides are being made at a more intensive utilization of the existing resource, substantial increases in domestic harvest are still necessary to meet the higher consumption levels generally encountered in western economies.

FOREWORD

About CINTRAFOR ...

The Center for International Trade in Forest Products (CINTRAFOR) was established to respond to the opportunities and problems of the export and import of wood and fiber products. It is a unique partnership of US academic, business and public policy makers at the state, regional and federal levels. CINTRAFOR provides educational, research, and public service support to increasing the nation's competitive international wood and fiber products marketing.

About FEPA ...

The Forest Economics and Policy Analysis (FEPA) Research Unit specializes in the development of advanced, computer-based analytical systems for investigating economic and policy problems in Canada's forest sector. It provides a Canadian focus for research in forest economics and modelling of forest resources, industrial production and international trade. The Research Unit also supports the training of graduates students in forest economics and policy analysis. Funding is provided by Forestry Canada, provincial forest ministries, and other agencies.

About this report ...

This report has received only limited editorial review. Views and opinions herein do not necessarily represent those of the funding agencies. It is distributed as a service to our readers. CINTRAFOR and the FEPA Research Unit welcome responses and critical comments on this paper and will publish short summaries of such replies in forthcoming newsletters in order to encourage debate and learning. Comments may be sent to:

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EXECUTIVE SUMMARY

OVERVIEW

This study of the forest resources of the Soviet Union and the export potential has revealed that the national timber base, while dominating the global timber supply picture, cannot be expected to support increased exports to either European or Asian markets in the short to medium term. A chaotic distribution system, uncertain replacement of existing domestic capital stock, environmental concerns further restricting timber supply, a huge and largely unfulfilled domestic appetite for forest products, low valued species located in a hostile environment, and uncertain ownership of the resource all conspire to restrict the likelihood of large positive changes in export volumes. Although very little is expected to take place in the short term, substantial development may be possible in the medium to long-term should the political and economic uncertainties be resolved however.

The forest resources of the European USSR are almost completely utilized. While harvest levels from the coniferous resource are expected to decline due to industrial pollution and past forest management practices, the hitherto unutilized deciduous resource will compensate for this. Thus, the harvest from the European USSR is expected to be unchanged, although the share of deciduous species will rise.

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exports to the rest of the Soviet Union may be directed for external export to Asian markets, inherent difficulties with the existing infrastructure may work against a substantial portion being available for export.

In the medium to long-term, a huge and largely unsatisfied domestic demand for forest products throughout the Soviet Union could possibly absorb a significant share of the potentially available timber resource. While great strides are being made at a more intensive utilization of the existing resource, substantial increases in domestic harvest are still necessary to meet the higher consumption levels generally encountered in western economies.

With the decline in harvest from federal lands in the United States Pacific Northwest in response to environmental pressures, there is a growing need to develop a better understanding of the timber resources in the Soviet Union. The USSR accounts for more than 800 million hectares of the world's inventory of stocked forest land and nearly 86 billion cubic meters of growing stock. This represents almost 27 percent of the global forested land and more than 25 percent of global standing volume. The Soviet share of world coniferous forested area (52 percent) and world coniferous volume (57 percent) is especially significant. While the USSR contains sizeable area and volume of deciduous species (250.9 million hectares and 19.2 billion cubic meters), it accounts for only 13 percent of the global deciduous stocked forest land and 8 percent of the global deciduous growing stock. An appreciation of the forest resources of the Soviet Union is clearly necessary to develop a realistic picture of future developments in the international timber economy. The next sections review the forest resource inventory, harvest, and internal demand from a national perspective. An overview of the regional distribution of various forest industry statistics is then presented. The outlook for each of the four regions is then examined.

FOREST RESOURCES

Ownership

The government, through various ministries and organizations, controls 98 percent of the Soviet Union's forest resource. One half of the stocked forest land and almost 60 percent of the standing volume have been classified as mature or over-mature.

Most of the land in the forest fund in government controlled forests is under the management of organizations belonging of the forest economy, otherwise called the

forest authorities. These organizations, primarily belonging to *Goskomles* or the USSR State Committee for Forestry, account for over 90 percent of the stocked forest land and nearly 90 percent of the standing volume.

Species

The dominant share of the forest resource is concentrated in coniferous species which account for three-quarters of the stocked forest land and growing stock. The primary coniferous species is larch, which accounts for more than half of the coniferous area and volume and nearly 40 percent of the total stocked forest land area and growing stock in the Soviet Union. Larch is followed by pine, cedar pine, spruce and true firs in descending order of importance. Deciduous species collectively occupy nearly 20 percent of the forest resource. The predominant deciduous species are birch and aspen. Brush and other species of lower importance account for the remainder.

Topography

Mountain forests contain a significant share of the timber resources of the Soviet Union. More than one-third of stocked forest land and growing stock are contained in mountain forests. Mountain forests also account for 43 percent and 37 percent of the total stocked forest land and corresponding growing stock of Group I forests, 27 percent and 30 percent of Group II forests and 64 percent and 39 percent of Group III forests. Group I forests have primarily environmental protection roles while Groups II and III forests are directed more to providing products for the forest industry.

Accessibility

Stocked forests which could be managed by the forest authorities for the production of timber account for 703 million hectares of the 803 million hectares of forest land. Almost one-quarter of the forests are classified as being in reserve. They are believed to be beyond the limits of major transportation systems expected to be completed within the course of the next 15 to 20 years. Additional forested land amounting to more than 100 million hectares has been set aside due to non-commercial species and low volumes per hectare, and forests in which harvesting directly conflicts with the environmental protection role. Thus, the exploitable forest amounts to 406 million hectares, or just 60 percent of the forest land base managed by the forest authorities.

Of the 406 million hectares and 50 billion cubic meters considered exploitable by the Soviets, coniferous species account for nearly 75 percent of the accessible and potentially accessible growing stock. Deciduous species represent almost 25 percent. This realistically exploitable forest managed by the forest authorities is believed to have supported an AAC of about 625 million cubic meters in 1989.

In addition to the forest resource administered by agents of the forest economy, another 62 million hectares of stocked forest land supporting 7 billion cubic meters of wood are available for timber harvest in the near to medium term. Coniferous species account for less of the forest resource, but still occupy slightly more than half of the stocked forest land and nearly two-thirds of the growing stock. This additional forest resource is believed to support an AAC of approximately 35 million cubic meters.

Total forested land and growing stock, then, available for exploitation is thus thought to be 468 million hectares and 57 billion cubic meters. The AAC supported by this total forest resource is estimated to be between 660 million and 670 million cubic meters.

Allowable Annual Cut

The realistically exploitable forest managed by the forest authorities is believed to have supported an AAC of about 625 million cubic meters in 1989. The forest resource managed by non-forest authorities is believed to support an AAC of approximately 35 million cubic meters. The total AAC is estimated to be between 660 million and 670 million cubic meters.

The AAC in forests which are believed to be beyond the location of major transportation systems which are projected to be completed within the course of the next 15 to 20 years amounts to between 192 million and 201 million cubic meters. These forests are thought to be under the administration of the forest authorities. This volume is not expected to be realized, and hence is not realistically considered as relevant to potential harvest over the next two decades.

While overcutting in the past definitely contributed to the present decline in the AAC, future stability of the current AAC may be in jeopardy from completely separate factors. These factors include air pollution, insect and disease attacks, and forest fires. These factors have contributed to an estimated decline in the carrying capacity

of the forests of the Soviet Union of at least 10 percent. Thus, an AAC in the short to medium term of 570 million cubic meters seems likely for forests under the management of the forest authorities and approximately 600 million cubic meters for the country as a whole when including the forest resource managed by organizations other than those of the forest economy.

Reforestation - Maintaining the Resource Base

Current reforestation efforts appear to be keeping pace with clear cutting. However, more disturbing developments are evident in the rate at which previously reforested stands are passed into the youngest age categories of the forest fund. Between 1985 and 1989, the average area of forests which were admitted into the youngest age classes has never exceeded 1.7 million hectares. In 1989 in fact, there was a sharp drop to 1.4 million hectares, only slightly more than two thirds of the area which is reported clearcut annually in the Soviet Union. In addition, there has been a marked deterioration in the share of stands admitted to the forest fund which were initially restocked using artificial means. While in 1980 and 1985 plantations accounted for almost 50 percent of the new stands that were considered stocked, by 1989 this share had decreased to 33 percent or only 468 thousand hectares. Assuming a 20 year period between the time a stand was established and reaching the lowest age class for the forest fund, only about 36 percent of the stands originally restocked using artificial means have been successful.

While the above discussion would suggest that the forest wealth of the Soviet Union is being reduced, estimates of the stocked forest land from successive forest inventories shows a constant increase. From 1953 until 1988, forest land has increased continuously from 815 million hectares to 942 million hectares. Stocked forest land has increased from 697 million hectares to 814 million hectares. Thus, even though the national statistics suggest an expanding forest resource, the underlying quality of that resource may in fact be decreasing.

HARVEST LEVELS

The forest industry of the Soviet Union has "officially" produced between 355 million and 390 million cubic meters of roundwood annually since 1960. Excluded from these figures are thought to be approximately 80 million cubic meters of harvest from small operations which lie outside the control of the main participants of the forest

economy. This additional harvest amounts to nearly one-fifth of the "official" harvest figures generally reported by the Soviet authorities.

Clearcut harvest accounts for almost four-fifths of the total harvest. Selective harvesting in mature stands accounts for a small share of overall harvest volume. It is the harvest from these methods of cutting which is accounted against the AAC. The remaining 20 percent of the harvest is derived through thinnings and sanitation harvesting, and harvesting connected with economic development. This balance of one-fifth is not considered when examining the degree to which the AAC is utilized; but is still believed to be part of the "official" harvest.

The AAC from the non-forest authority resource is believed to be fully utilized, and may in fact be over committed. The AAC under administration of the forest authorities however, appears to be not completely utilized. While almost 50 percent of the AAC was harvested in 1989, coniferous species are more heavily utilized than the deciduous species. In 1989, 60 percent of the AAC attributed to coniferous species was harvested versus nearly 40 percent for deciduous species.

From this discussion, it follows that most of the unutilized AAC is under the administration of the forest authorities which is estimated to be 293 million cubic meters.

TIMBER DEMAND AND CONSUMPTION

The potential pent up demand in the USSR is enormous. For the USSR to approach the per capita consumption of West Germany in 1989, let alone the United States, would require additional import/production of 15 million metric tons of pulp. This is the equivalent of 140 percent increase in existing capacity; and represents an impressive 60 percent of the 1989 world exports of wood pulp. For paper and paperboard, this would require more than 45 million metric tons of new capacity. This represents more than a 400 percent increase over the current production level; and nearly 100 percent of the 1989 world paper and paper board trade. For wood based panels, an increase in capacity or imports of nearly 30 million cubic meters is required. This is nearly 200 percent above the current capabilities; and would represent nearly 100 percent of current world export volume.

The additional fibre requirement represented by these potential consumption volumes is 255 million cubic meters. The additional requirement is less than the 293 million cubic meters of the currently unutilized AAC.

Soviet estimates for fibre needs in the near to medium term are more modest, suggesting an additional 100 million cubic meters of fibre are needed. While the higher demand is expected to be satisfied by an increase in use of by-products such as chips and recycling of paper products, overall harvest is projected to rise between 30 million and 40 million cubic meters as well.

It is unlikely that Soviet exports will be voluntarily decreased in the near term in order to meet the projected increase in internal demand due to the need to generate hard currency. Thus any increase in consumption must come from either imports (unlikely given the shortage of hard currency) or from increased domestic production.

The ability of the industry in the USSR to meet the demands placed on it can best be answered by examining the inventory and harvest on a regional basis. Statistics which describe the forest inventory, harvesting, and consumption on a national level mask a wide regional variation that effectively divides the country into four separate regions. These regions are: (1) The European USSR; (2) Central Asia; (3) Transition RSFSR or Western Siberia; and (4) Pacific Asian USSR or East Siberia and The Far East.

REGIONAL DISTRIBUTION

The European region contains the majority of the population and forest industrial activity. Pacific Asian USSR, on the other hand, contains the majority of the forest resource but is underdeveloped in terms of industrial activity. The Transition RSFSR region is located between these two major regions of the Soviet Union, and thus has a more balanced pattern. Central Asia is a minor contributor to the forest industry of the Soviet Union.

The European USSR and the Transition RSFSR regions have the least rugged terrain. Mountain forests generally account for less than 15 percent of the forest resource. In both the Central Asia and the Pacific Asian regions, mountain forests account for more than one-third of the stocked forest land and more than one-half of the growing stock.

The large difference in terrain impose broad restrictions on the species make up of the forest resources in each of the four regions. The European region, due to more temperate climate, contains a disproportionately higher share of the deciduous resource. The distribution of the forest resource among the two principal species groups is reflected in the allocation of the AAC. While accounting for approximately one half of the AAC in the European and Transitional RSFSR regions, coniferous species contribute almost three-quarters of the regional AAC in the Pacific Asian region. Just over one half of the coniferous AAC for the total USSR is located in the Pacific Asian region. The AAC from deciduous species, on the other hand, account for almost fifty percent of the regional AAC in each of the Transitional RSFSR and European USSR region. The European region alone accounts for nearly 50 percent of the AAC from deciduous species.

While the coniferous resource is the dominant species group across the country, the species which compose this group in each of the regions are decidedly different. In the European USSR, spruce and pine account for all of the coniferous resource. While pine is the major species in Transition RSFSR, occupying one half of the coniferous forested area, cedar pines contribute nearly one-quarter. Spruce and larch account for most of the remainder. Larch dominates the forest resource of Pacific Asia, occupying almost three-quarters of the forested land and nearly three-fifths of the growing stock. Pine is the next major specie, accounting for only 12 percent of the forested land and 16 percent of the inventory volume. Spruce and cedar pine account for most of the remainder. Birch and aspen account for the majority of the deciduous resource except in Central Asia where the principal deciduous species are those species commonly encountered in desert environments.

The age structure of the forest resources also differs across the regions. Since the European USSR is the most developed region and has supported the dominant share of the harvest over most of this century, it is not surprising to see that immature stands predominate, accounting for 53 percent of the forested area and 60 percent of the growing stock. In the Transition RSFSR and the Pacific Asian regions, because development started in earnest only after the Second World War, the forest resource is predominantly mature and over-mature. Mature and over-mature forests account for 53 percent of the forested land and more than 60 percent of the growing stock of these two regions respectively. The forests of Central Asia consist mainly of

immature stands which account for more than three-quarters of the stocked forest land and nearly two-thirds of the growing stock. The generally younger age structure of the forests is due to a strong afforestation program started in the region to prevent further encroachment of the desert areas onto the cultivated and habitable parts.

As the European region supports the largest share of the harvest (and other industrial activities as well), but contains only 40 percent of the accessible and potentially accessible resource, it is not surprising to see the allowable annual cut nearly completely utilized. The AAC in the Transition RSFSR and the Pacific Asian region account for nearly 60 percent of the accessible and potentially accessible AAC. However, no more than 40 percent of the resource is being utilized. The balance of the unutilized AAC requires substantial investments in infrastructure to bring it to the developed stage. An insignificant share of the AAC is located in Central Asia, amounting to less than one percent or 3 million cubic meters. Thus most of the potential for harvest increase is located in the Asian Pacific and Transitional RSFSR regions.

REGIONAL OUTLOOK

Roles

It is possible to hypothesize four roles played by the four regions. In addition to supplying the needs of the domestic industry, the non Central Asia regions must also seek to meet export commitments which in the past five years have mounted to between 15 million and 20 million cubic meters, or almost 5 percent of the "official" harvest of nearly 385 million cubic meters. Approximately half of the log exports have been destined for Asian markets of China and Japan. The remaining half has been exported to East and West Europe. Since exports to Asian markets originate no further west than Pacific Asia, the forest industry in Pacific Asia must in addition to domestic and other internal demands to the USSR, also meet the export requirements of the Pacific Basin. Correspondingly, the forest industry in the European USSR must also consider the market needs in Europe. Transitional RSFSR, thought to be a marginal supplier for international export markets, also provides raw material for the industry of the European USSR in addition to meeting its own internal supply needs.

The export of unprocessed logs is one of the commodities which the Soviet Union currently is successful in exporting to markets where payment is in hard currency.

There will likely be pressure to maintain unprocessed log exports, at least in the short to medium term, in order to generate hard currency necessary to finance the import of needed equipment and consumer goods. At the same time, the consumption of wood fibre has been projected to increase by up to 100 million cubic meters in the near to medium term.

While it is projected that 60 percent to 70 percent of the needed increase will come from more intensive use of wood residues and by product material, additional roundwood must still be obtained in the amounts of between 30 and 40 million cubic meters. In the absence of major shifts in processing capabilities, most of the projected demand for roundwood is expected to occur in the European USSR where the majority of the population and manufacturing capacity are located. In the absence of decreasing log export, there are questions as to where this additional output can be obtained.

European USSR and Transition RSFSR

Short to Medium Term Outlook

Most of the potential increases in the near to medium term are expected to occur in the European and Transition RSFSR regions. Almost 36 million cubic meters of deciduous species are thought to be accessible subject to securing the appropriate manufacturing technology. An additional 10 to 12 million cubic meters consisting of two-thirds coniferous species (pine and spruce) and one third deciduous species (birch and aspen) can be generated simply by changing the regulations governing harvest from Group I forests. In addition, introduction of fiscal incentives to compensate for the higher harvesting costs connected with selective harvesting techniques could increase volume from intermediate harvesting by 30 million cubic meters. Only half of this is thought to be of commercial quality however. The high cost connected with this source of incremental volume makes it sub-marginal.

This suggests that the ceiling on the level of potential increases in harvest from both European USSR and Transition RSFSR regions is in the neighbourhood of 45 million cubic meters. But how does this compare with the projected fall down in AAC connected with industrial pollution and past forest management practices?

The forest resources of the European USSR are being exploited at or beyond the current ability of the resource to sustain itself. On account of poor harvesting and

forest management practices when coupled with a climate which is more favourable to deciduous species (than that existing in the Pacific Asian region), their share of the total harvest is likely to increase in the near to medium term. Thus, while the overall coniferous component is expected to decline, the total harvest will not because of the substitution of hitherto unutilized deciduous resource for the over developed coniferous resource.

Incremental harvest is possible from greater intermediate utilization by increasing the degree of thinning in immature stands. However, without fiscal incentives and new technology to compensate for the higher costs associated with selective harvesting techniques, it is unlikely in the short to medium terms to lead to any sizeable increase.

Thus, any increase in manufacturing capacity of the forest industry in the European USSR must be achieved through a more intensive utilization of existing forest resource, including a shift to greater use of the available deciduous resource.

Long-term Outlook

In the short term in the Transition RSFSR region, the harvest might be increased by 6 million cubic meters of mainly deciduous species if appropriate manufacturing technologies can be introduced. Longer term increases in the Transition RSFSR region are dependant on foreign capital. An additional 55 million cubic meters could be possible but only with the investment of large sums of capital for infrastructure development. This additional volume is connected with the potentially accessible AAC. However, even with capital investment, the potential harvest increase in Transition RSFSR is far from foreign markets, thus decreasing the attractiveness in the eyes of foreign investors. Therefore, it is unlikely Transition RSFSR will witness any large increase beyond the projected rise in harvest of deciduous species. The projected increase more or less compensates for the potential reductions in the accessible AAC believed to be likely from industrial pollution and past forest management practices.

The reserve and inaccessible forest resource in both European USSR and Transition RSFSR represented by about 20 million cubic meters of AAC is believed to have either high economic or high environmental costs associated with it. Thus, it is unlikely that additional wood volume can originate from these forests.

Pacific Asian USSR

Short to Medium Term Outlook

Some potential additional increases from the stands which are presently developed is possible. By making better use of the deciduous resource believed to be developed (except for the appropriate manufacturing technology) an additional harvest of 7 million cubic meters of deciduous species could potentially be possible. An extra 15 million cubic meters of mainly coniferous species is believed to be accessible at this time in all ways except for the appropriate harvesting technology. Thus, the increase in harvest from either importing the harvesting technology for steeper slopes or manufacturing processes which can use the deciduous resource amounts to approximately 22 million cubic meters, or nearly 20 percent of the present harvest.

Long-term Outlook

With so much of the reserve forests and remaining unallocated volume, Pacific Asian Region has always seemed like a cornucopia of growing stock, particularly now in light of the restrictions placed on the harvest of timber from federal lands in the United States. However, most of the volume and land area is located in Yakut ASSR and the undeveloped parts of Khabarovsk Kray. Weather conditions are severe and timber is reportedly of smaller size and poor quality. Stocking per hectare is low, almost 80 cubic meters per hectare in the reserve forests of Yakut ASSR. This makes development economically marginal at best. In addition, the uncertainty surrounding the regeneration of stands once harvesting is complete in the harsh climates has yet to be resolved.

The combination of low quality and low value species, low stocking, and harsh climate contribute to high operating costs. Together with the uncertain sustainability of the resource, these factors all mitigate against large supplies of wood originating from the reserve forests coming to market from the Asia Pacific region in the short to medium term, let alone over the longer-term.

The difference between the stated AAC in the currently and potentially accessible forest land, and the actual harvest, represents the currently undeveloped portion of the "official" AAC. The development of this added volume, estimated to be 135 million cubic meters in Pacific Asia and 55 million cubic meters in Transitional RSFSR, is dependent on capital investment.

Capital Investment

What is the outlook for massive capital injections from Soviet sources in the near to medium term?

Individual forest enterprises can no longer expect to receive capital infusions from the central government(s). The individual enterprises are currently being placed on a self financing basis under economic and price reforms.

While retaining a share of the hard currency earnings generated by the sale of their products, the share of earnings remaining with the enterprise was reportedly recently reduced from 25 percent to 15 percent for 1991 to assist the central government to meet its hard currency obligations. Thus the ability of the individual enterprises to import foreign technology in its own right is uncertain and does not look very promising in the near to medium term.

Reported administrative changes in the share of hard currency retained by the individual enterprises may seriously undermine the ability of the Soviet forest industry to continue harvesting at current levels, let alone increasing the volume of exports. In addition, as the centrally planned economy shifts to a market oriented one, the ability of the forest industry to replace Soviet made capital stock from within the country may decline. Thus, while harvest increases in the order of 70 million cubic meters seem to be potentially possible with minimum investment in the infrastructure, the ability of the forest industry to attain this harvest may in the short term be deteriorating. Actual declines in the current harvest levels cannot be ruled out.

One alternative heavily promoted is investment by foreign firms to help bring to production currently undeveloped forest land and provide marketing expertise to facilitate the export of Soviet manufactured products. Backman and Waggener observed that the investment conditions in 1990 were murky, thus clouding the outlook for foreign investors. Since then, a number of joint ventures have started to operate, the most notable being the joint venture between Hyundai and the Primory'e forest industry association. While Hyundai has made great strides in developing what is believed to have been forest resource classified as "potentially developable", it is far from clear whether other major foreign companies will decide to make the commitment for investment in the near term. Although very little is expected to take

place in the short term, substantial development may be possible in the medium to long-term should the political uncertainties be resolved.

The joint venture between Hyundai of South Korea and the Primorye Forest Industry Association of the Soviet Far East demonstrates that there is definite interest on the part of foreigners to cultivate the potential wood supply. However, the interest, particularly in the Pacific Asian region, to invest in developing the harvesting potential depends on the ability of the investment to generate hard currency profits and to be able to repatriate the profits. Given the distribution of the resource and industrial activity, the European USSR is a more likely candidate for investors seeking opportunities in manufacturing and secondary processing while those seeking additional raw material should examine the Pacific Asian region.

Foreign Market Considerations

Regardless of the impediments to foreign investment internal to the Soviet Union, the increase in harvest connected with increasing foreign investment is limited by market considerations. The size of the market in which it is possible to receive hard currency and in which Soviet timber (species and quality) are competitive affect the ability of the foreign investor to recoup the investment. The market size in the Pacific Basin for sawlogs of coniferous species was nearly 28 million cubic meters in 1989. The United States supplied approximately two-thirds of the market while the USSR supplied about 20 percent. Through partial substitution, an increase in Soviet exports may be possible. Should the Soviets be able to capture two-thirds of the market for coniferous sawlogs presently serviced from North America, the harvest in the Pacific Asian region would need to increase by at least between 10 and 15 million cubic meters.

PREFACE

Geo-political change within the USSR has captured the attention of much of the Western world in 1991. Yet even prior to the remarkable events of the current drama being played out among the Central Soviet government and the 15 republics, winds of change brought on by Perestroika and Glasnost had suggested the need for a "fresh look" for those interested in the dynamics of the Soviet role in world affairs for the 90's and beyond. This need was equally evident for those involved with the forestry and forest products sector. Due to the huge land base and physical resources of the USSR, the Soviet Union is poised to play a significant role in emerging global trade in forest products in both Pacific and European markets. But how real is the Soviet potential? Will reformist policies significantly impact the forestry sector? Will global investment be drawn to the USSR forests in order to realize the physical and biological potential? Can the Soviet forests be economically developed in the face of global competition?

These and related questions have been central to ongoing CINTRAFOR research over the past two years. A major overview profile of the Soviet forestry and forest products sector, with an emphasis on trade relationships, was published in mid-1990.¹ Additional investigation was undertaken relative to changing economic and political circumstances in Eastern Europe.² Work in progress includes analysis of Soviet trade relationships in forest products with Japan and other markets of the North Pacific region.

Underlying an understanding of the emerging Soviet role in forest products is the need for comprehensive and current knowledge of the Soviet forests: the scope and extent of the forest land base, the pattern of organization and administration, and the forest inventory structure, including determination of harvest levels. Future sustainability of harvests and the potential mix of species and quality of timber are equally important issues.

Detailed information regarding the Soviet forests is difficult to obtain, particularly for those in the West utilizing literature published in English. Contemporary analyses are few, and generally utilize information derived from Soviet forest inventories conducted in 1978 or 1983.

The Soviet forest authorities conducted a major inventory of forest resources in 1988.³ This inventory is not widely available, and has not received careful analysis in the West. Utilization of this updated information is central to the CINTRAFOR focus on

¹ Backman, C.A. & T. R. Waggener, "Soviet Forests at the Crossroads: Emerging Trends at a time of Economic and Political Reform", Working Paper #28, Center for International Trade in Forest Products (CINTRAFOR), College of Forest Resources, University of Washington, Seattle, Washington, June 1990, 387 pages

²Waggener, T.R. & C.A. Backman, Eastern Europe Trade in Forest Products: Changing Role of the USSR and Opportunities for the US Forest Products Industry, Report prepared for International Trade Division, National Forest Products Division, Washington, D.C. October 1990, 294 pp.

³ Staticheskiy Sbornik - Lesnoy Fond SSSR (1988), (The National Forest Inventory of the USSR), Volume I, State Committee for Forestry, Moscow, 1990, 1005 pp.

the Soviet forestry and forest products sector. It is hoped that the present paper, presenting an English interpretation of the basic forest inventory information and disaggregated for the four major forest regions of the Soviet Union, will be useful to other scholars and business interests seeking insights into the future of the USSR forests on the global scene.

It should be noted that Soviet data regarding its forests is not always complete or internally consistent with respect to definitions, aggregation, or source. For this reason, several original Soviet sources have been utilized in the present work as is noted in the footnotes and bibliography. Much of the data has been recompiled based on the authors' interpretation and understanding of the diverse classifications and aggregations used in the original source documents. While every effort has been made to preserve the intent of the original data classifications and definitions, meaningful English-based terminology has been adopted in order to assist in understanding the Soviet forestry sector. Errors, omissions or misinterpretations remain the responsibility of the authors. Readers are urged to communicate with CINTRAFOR regarding questions or interpretations arising from this analysis.

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INTRODUCTION

With the decline in harvest from federal lands in the United States Pacific Northwest in response to environmental pressures, there is a growing need to develop a better understanding of the timber resources in the Soviet Union. The USSR accounts for more than 800 million hectares of the world's inventory of stocked forest land (Table C1) and nearly 86 billion cubic meters of growing stock (Table C2).¹ This represents almost 27 percent of the global forested land and more than 25 percent of global standing volume. The Soviet share of world coniferous forested area (52 percent) and world coniferous volume (57 percent) is especially significant. While the USSR contains sizeable area and volume of deciduous species (250.9 million hectares and 19.2 billion cubic meters), it accounts for only 13 percent of the global deciduous stocked forest land and 8 percent of the global deciduous growing stock. Evident from **Figure 1**, which shows the distribution of global coniferous and deciduous growing stock, an appreciation of the forest resources of the Soviet Union is clearly necessary to develop a realistic picture of future developments in the international timber economy.

The objective of this report is to examine the ability of the Soviet Union to be a continuing significant supplier of forest products (focussing on roundwood) to world markets.

Figure 2 shows the Soviet Union consisting of 15 separate republics.² The republics are connected together by innumerable commercial and economic ties. It is expected that these internal ties will continue at least for the short to medium term.³ Therefore, it is appropriate to consider only the resource which will be available for

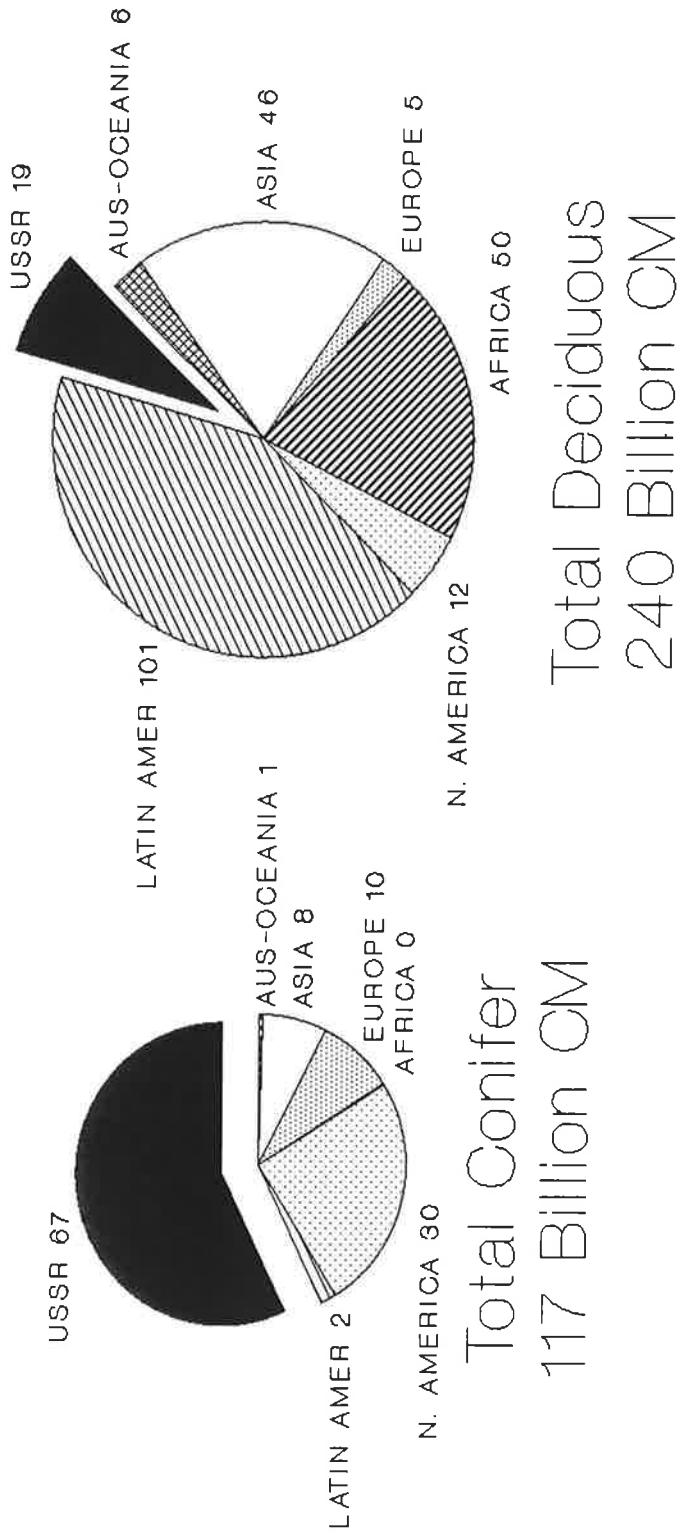
¹All tables referred to in the text are located in Appendix C.

²The Soviet Union has consisted of 15 republics. These republics are Latvia, Estonia and Lithuania, Moldavia, Belorussia and the Ukraine, Georgia, Azerbaijan, and Armenia, Kirgiz, Tadzistan, Uzbekistan, Turkmenistan and Kazakhstan, and Russia.

³The republics of the USSR are bound together by innumerable trade links which cannot be severed as easily as the political chains that bound the 15 separate republics together into the Soviet Union. The non-Russian republics were net importers of roundwood in 1985 and 1989 of nearly 37 million cubic meters of industrial wood from Russia. In return for *inter alia* roundwood from Russia, the other republics exported various goods and services. The lack of hard currency which has existed in the USSR undoubtedly exists for each of the separate republics as well. The lack of hard currency and the production of goods and services which do not meet quality standards in the West will mean that existing trade relations within the USSR will continue, at least for the near to medium term.

GLOBAL TIMBER INVENTORY BY REGION CONIFER & DECIDUOUS GROWING STOCK

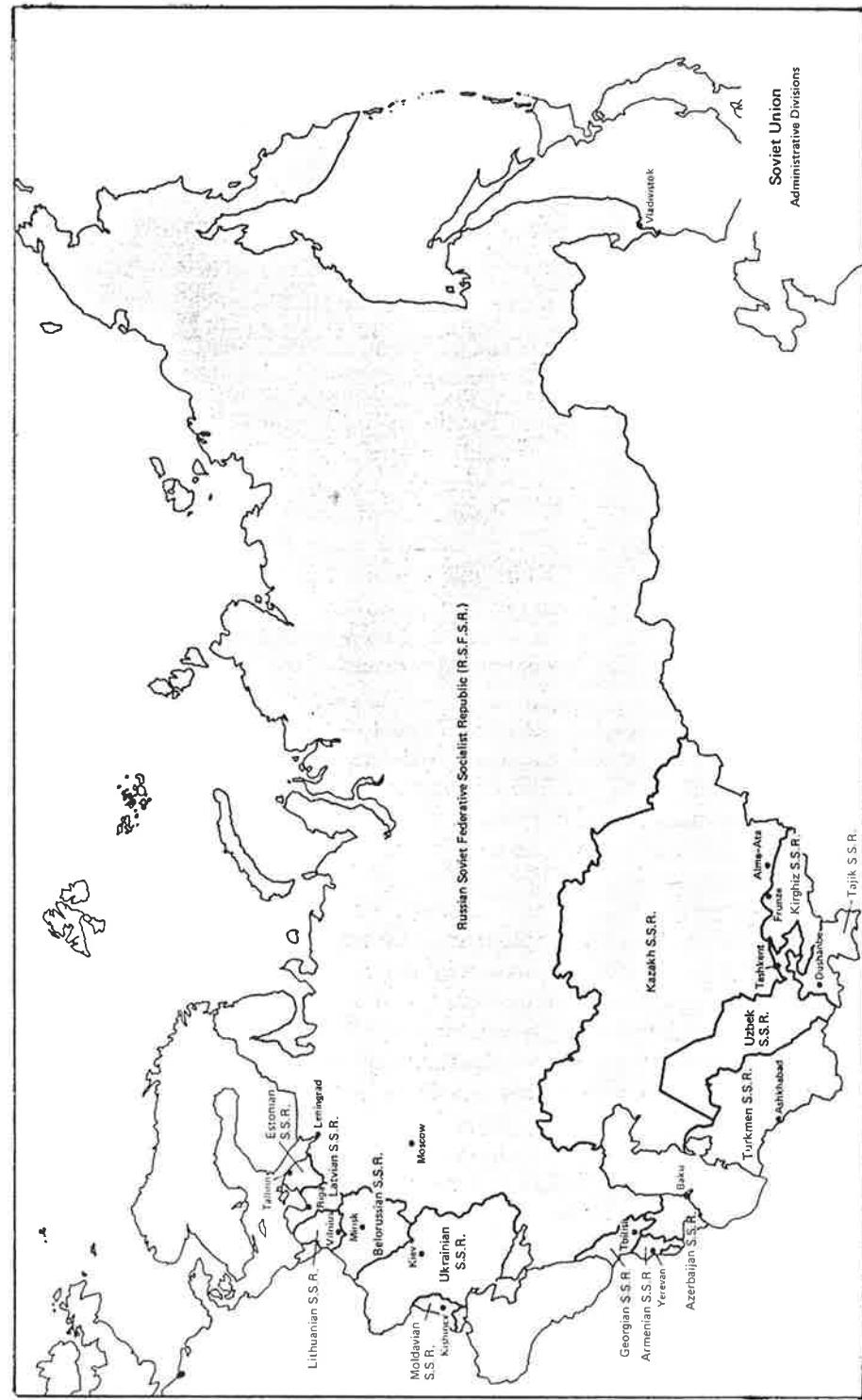
Billion Cubic Meters



CINTRAFOR/trw

Figure 1

THE REPUBLICS OF THE SOVIET UNION



external trade with the rest of the world. Thus, the USSR as a whole is taken as the starting point of the analysis.

The largest republic, Russia, dwarfs all others in the share of the Soviet forest resource, containing: 95 percent of the land area, 94 percent of the forest land, 95 percent of the stocked forest land, and 95 percent of the growing stock of the national forest inventory. While future political and economic events may dictate a smaller and more compact USSR, with most of the forest resource concentrated in the Russian republic, the observations of this report are pertinent for the smaller Soviet Union as much as they are for the larger Soviet Union.

This paper first describes the forest resources and harvesting pattern of the Soviet Union, and then proceeds to divide the country into four broad geographic regions that coincide with the major locations of the resource and the location of the major timber consuming areas.⁴ Each region is discussed separately. The final section discusses the implications of the surpluses/deficits revealed in the sections pertaining to each region. Extensive statistical and supplementary descriptive information is contained in three appendices.

⁴Much of the data about the inventory of the forest resources in the Soviet Union is restricted to land that has been under control of the central forest authorities, primarily The State Committee for Forestry (*Goskomles*). This includes data on site class and stocking, species, and use groups (environmental protection, aesthetic, or industrial for example). Thus, much of the remaining description of the forest resources is by necessity restricted to this subset of the inventory data which contain 86 percent of the stocked forest land and 88 percent of the growing stock of Soviet Union totals.

THE SOVIET UNION

THE FOREST RESOURCE

Vegetation Zones

As **Figure 3** shows, the Soviet Union is divided into seven broad soil and vegetation zones based on different plant and soil associations. Soil and vegetation reflect a north-south gradation in, *inter alia*, temperature and rainfall. From the treeless tundras in the northern part of the country, further south, there are higher temperatures, rainfall and longer growing season which contribute to the formation of large forested regions consisting of tayga forests, mixed forests of deciduous and coniferous species, and deciduous forests. The forested zones blend into forest steppe and steppe, and finally into desert as the mean annual temperature, potential evaporation, irradiation, and growing season increase and rainfall decreases. Evident from **Figure 4**, the northern limit of forests is determined by thermal conditions, while the southern limit is determined by moisture conditions.

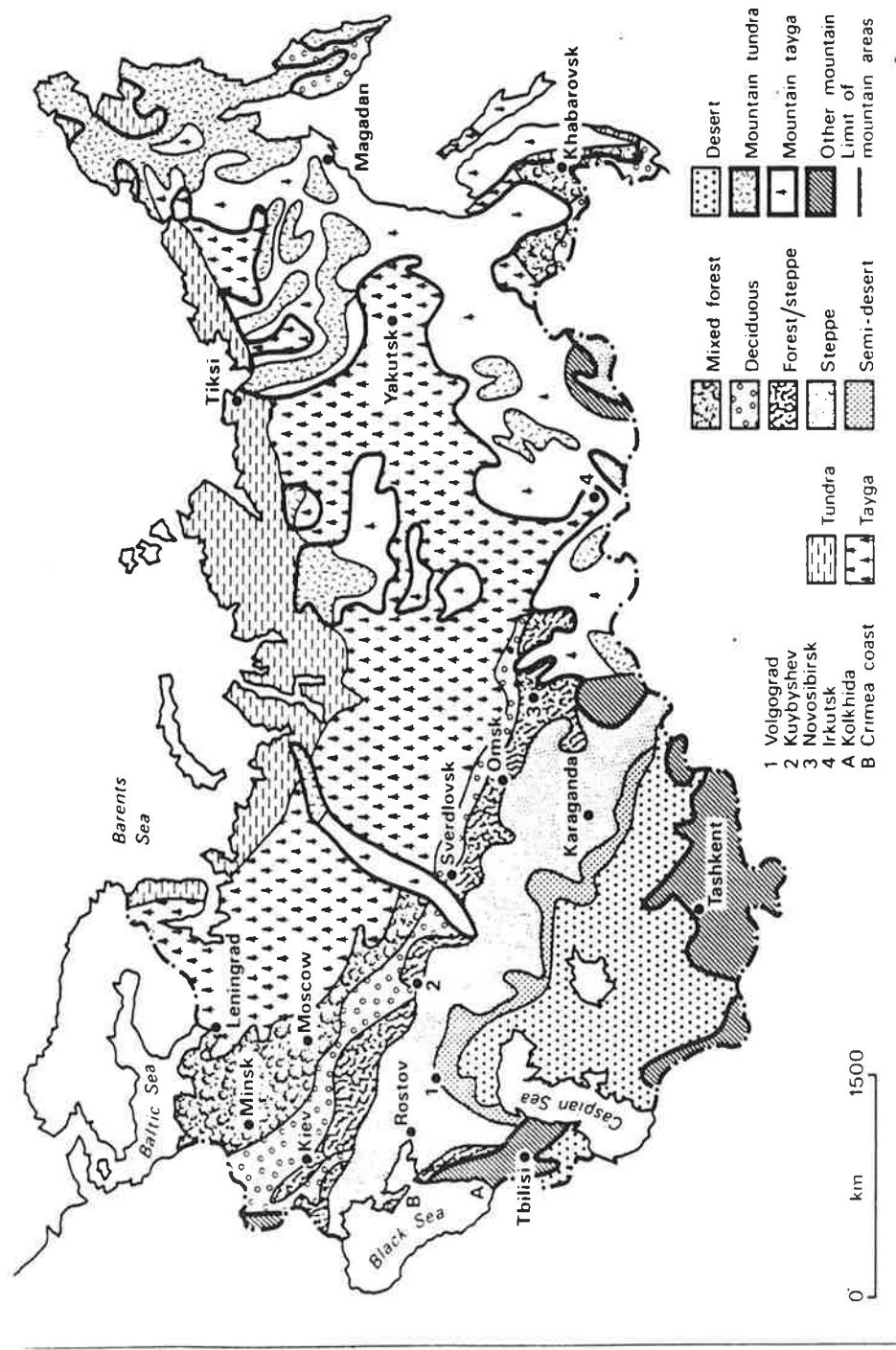
The general north-south gradation is modified and strongly influenced by mountainous regions where there is a succession of vegetation and soils from the lower to higher slopes based on temperature, precipitation, gradient, and aspect. In the eastern part of the USSR, tundra occurs far south of the Arctic coastline in the (cooler) mountain regions where the higher elevation offsets for the warmer temperatures normally encountered with lower latitudes. Similarly, coniferous forests can be found at higher altitudes much further south than its normal latitudes would suggest.

The mountainous regions of southern USSR display great diversity in soil and vegetation from the lower to higher slopes. In addition to the changes expected due to changes in elevation, the vegetation zones differ according to aspect. The northern slopes are influenced by arid conditions and the southern slopes by humid sub tropical conditions.⁵

The forest resources of the USSR are located primarily in the tayga and mountain tayga zones. Minor amounts are present in the mixed forest zone. Other zones such as the deciduous zone and forest steppe and steppe zones, while containing limited forest

⁵The Cambridge Encyclopedia of Russia and the Soviet Union, Brown, Archie et alia Editors, page 42

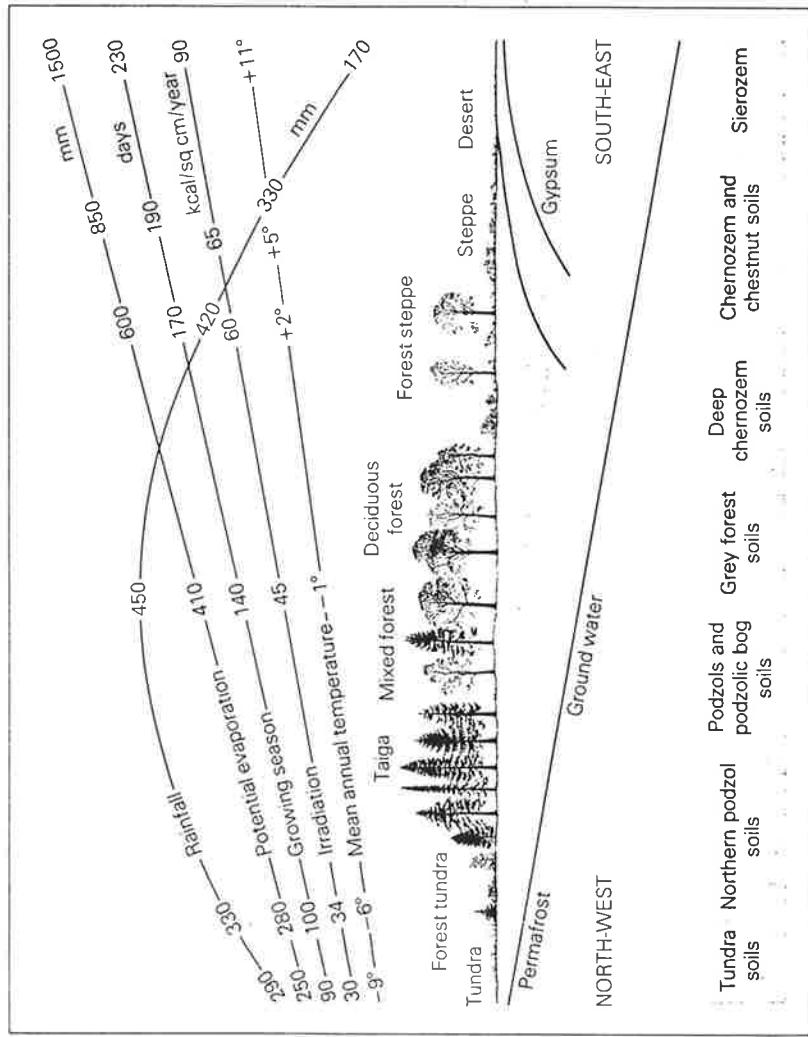
VEGETATION ZONES OF THE SOVIET UNION



Source: Geography of the Soviet Union, page 68

Figure 3

TEMPERATURE AND MOISTURE GRADIENTS IN THE EUROPEAN USSR



resource, contribute more to the agricultural output of the country.⁶ Semi-desert and desert zones do not contain significant forest resources.

Each of the major forested zones support a different mosaic of species. Pine and spruce species dominate the tayga forests of the European part of the USSR.⁷ Larch, because of its ability to survive the harsher climatic conditions characteristic of the Asian part of the USSR, predominates, particularly east of the Yenisey River which approximates one of the boundaries of the zone of permafrost, as well as the border between West and East Siberia.⁸ Figure 5 shows the approximate boundary of the permafrost region in the USSR. Pine is the major coniferous species in the zone of mixed forests where it occupies the dryer and more hilly sites. Basswood, oak, elm, and maple are the major deciduous species. In the deciduous zones of the European USSR, beech, oak and ash are present while in the Asian deciduous zones, birch and aspen predominate.

Appendix A contains a detailed discussion on the different vegetation zones of the Soviet Union. Appendix B provides an overview of the range of the important tree species which form the forest resource of the USSR.

The Forest Fund

The forest resources of the USSR are collected under one umbrella classification called "The Forest Fund".⁹ Detailed information which describes the national forest

⁶The Cambridge Encyclopedia of Russia and the Soviet Union, Brown, Archie et alia Editors, page 42

⁷The European Part of the USSR includes the following republics plus that part of the Russian Republic located west of the Ural mountains. The republics are Latvia, Estonia and Lithuania, Moldavia, Belorussia and the Ukraine, Georgia, Azerbaijan, and Armenia.

⁸The Asian part of the USSR includes the following republics plus the part of the Russian republic east of the Ural mountains. The regions included in the Russian part are West Siberia, East Siberia, and The Far East. The republics are Kirgiz, Tadzistan, Uzbekistan, Turkmenistan and Kazakhstan.

⁹The forest fund is the sum total of all forests in the USSR. To date, it is believed that the ownership of the forest resources of the country rests with either the Central or the Republic Governments, regardless of the organizations which have management responsibilities. Recent events strongly suggest that the republics will soon assume overall ownership however.

Management responsibilities have been delegated to government organizations or to collective farms. Forests under government stewardship include those managed by the central forestry organization called *Goskomles*, and organizations other than *Goskomles*. Should ownership of the forest resources come under the control of the republican governments, it is expect that stewardship would pass to the republican counterpart of the All-Union *Goskomles* or the respective ministries other than those of the forest ministry.

LIMITS OF PERMAFROST AND GLACIATION IN THE SOVIET UNION



9

Source: The Cambridge Encyclopedia of Russia and The Soviet Union, page 34

Figure 5

inventory are located in Tables C3 (which shows the stocked forest land) and Table C4 (which shows the inventory growing stock).

Area

The forest resources of the Soviet Union are primarily concentrated in the narrow band extending from about the 50 th parallel to the Arctic Circle. Shown in **Figure 6**, more than 1,250 million hectares are included in the forest inventory (or forest fund) of which 1,230 million hectares are under control of the government and 20 million hectares are controlled by non government collective farms.¹⁰ Of the total 1,250 million hectares, 940 million hectares are classified as forest land. All land allocated to the collective farms is considered as forest land, while only 920 million hectares of government land are so classified. Of the 940 million hectares of forest land within the forest fund, nearly 815 million hectares are considered as stocked. The government, through various ministries and organizations, controls 795 million hectares of stocked forest land, 730 of which are under the principal species identified above. Nearly 355 million hectares or 50 percent of the total stocked forest land is considered mature and over-mature. Nearly all of the forest land under control of the collective farms is stocked, all of which support commercially important species. Almost 2.3 million hectares are classified as mature and over-mature at this time.

Volume

Figure 7 shows that the stocked forest land in the forest fund supports 86 billion cubic meters of wood, of which 84 billion is under jurisdiction of the government.¹¹ Only 2 billion cubic meters are under jurisdiction of the collective farms. Almost 60 percent of the standing volume, or 48 billion cubic meters, has been classified as mature or over-mature. Nearly all of the mature and over-mature volume is located in forests of government control. Only 380 million cubic meters of mature and over-mature volume is managed by the collective farms. This represents less than 20 percent of the total volume in collective farms.¹²

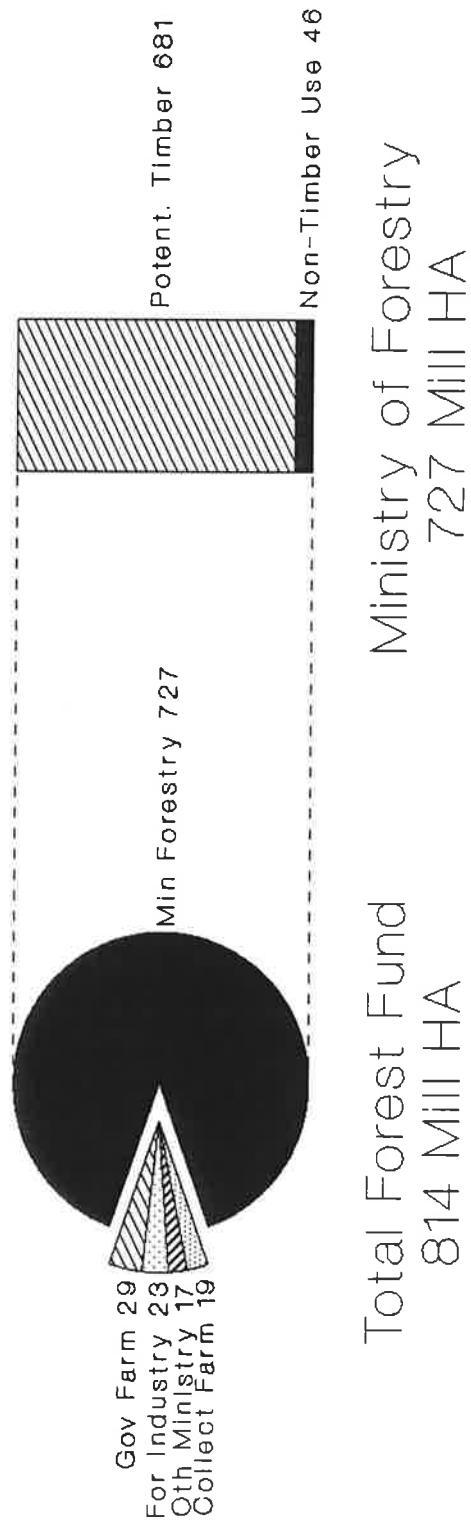
¹⁰Greater detail is shown in Table C3.

¹¹Table C4 shows in more detail distribution of growing stock.

¹²The lower share of inventory in the M & OM age classes is not surprising as the collective farm forests were initially set aside to meet the needs of the farms and local forest industry. It is believed that the collective farms are located in relatively well developed parts of the country. Thus, the M & OM wood would have been the least expensive to develop, thus leading to a higher rate of removals and therefore a lower share of M & OM inventory at present.

SOVIET FOREST LANDS BY MAJOR MANAGEMENT ORGANIZATION

Million Hectares

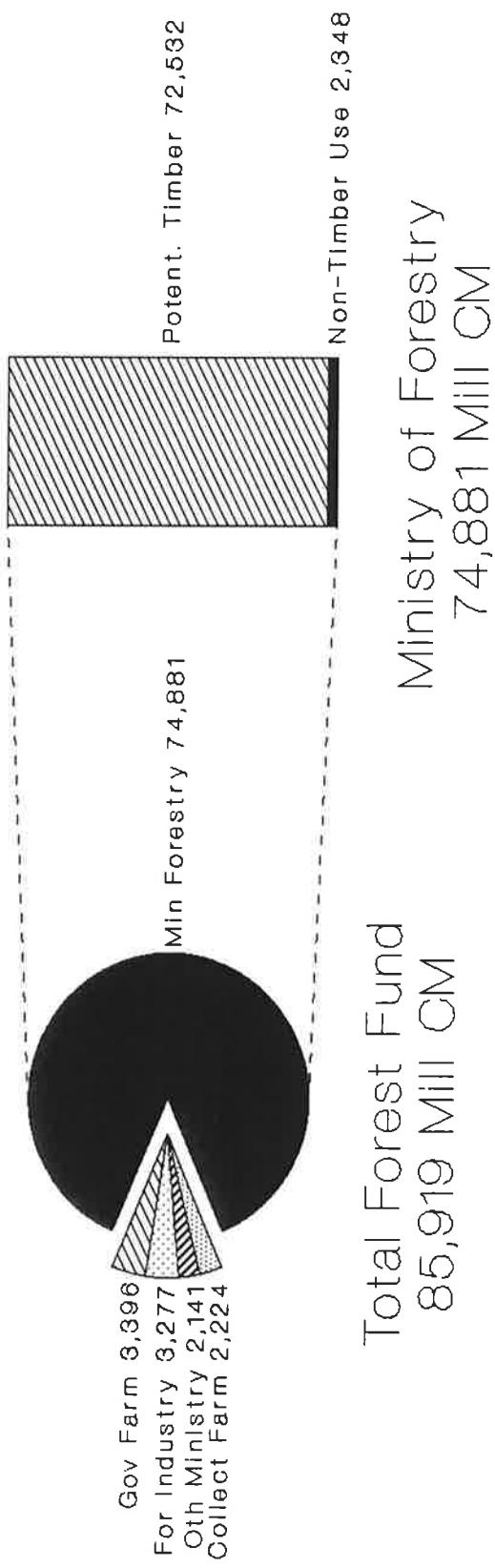


CINTRAFOR/cab/trw

Figure 6

SOVIET FOREST INVENTORY MAJOR MANAGEMENT ORGANIZATION

Million Cubic Meters



CINTRAFOR/cab/trw

Figure 7

Species Groups

The tree species growing in the Soviet Union are grouped into three broad categories depending on whether the tree species is a coniferous or a broad-leaf tree. Secondly, the classification depends upon whether the wood stress point of the broad-leaf tree species is greater than or less than 40 MPa.¹³ Broad-leaf tree species which have a wood stress point of less than 40 MPa are called softwood deciduous trees while trees with a wood stress point greater than 40 MPa are called hardwood deciduous trees. The division within deciduous species generally coincides with the classification advanced by Barr and Braden.¹⁴ Softwood deciduous species are shade intolerant while hardwood deciduous species are shade tolerant.

Most of the stocked forest land (nearly 570 million hectares) consists of coniferous species. While conifers account for 65 percent of the stocked forest land in the forest fund, nearly 85 percent of the 355 million hectares of mature and over-mature stands are coniferous species. The balance of the stocked forest land includes hardwood deciduous species (nearly 40 million hectares or 5 percent) of which more than 10 million hectares are mature and over-mature stands, softwood deciduous species (nearly 145 million hectares or 20 percent) of which more than 40 million hectares or 12 percent lie under mature and over-mature stands, and species of lesser importance, primarily brush (65 million hectares or 10 percent).

Coniferous species account for nearly 66 billion cubic meters of inventory or 77 percent of the total volume in the forest fund, with nearly 40 billion cubic meters considered mature or over-mature. This is almost 60 percent of the coniferous species growing stock. Hardwood deciduous and softwood deciduous species account for nearly 3 billion cubic meters (or less than 5 percent) and 15 billion cubic meters (or more than 15 percent) respectively of the total volume. The mature and over-mature component of the deciduous species account for one billion hectares of hardwood deciduous and 7 billion cubic meters of softwood deciduous species,

¹³MPa is an abbreviation for megapascals. MPa is a unit of measure common in the International System of Units (SI) to denote stress. One pound per square inch (psi) equals approximately 0.007 MPa. (Haygreen, John G. and Bowyer, Jim L., Forest Products and Wood Science - An Introduction, Second Edition, 1989, pages 209-210)

¹⁴Barr, Brenton and Braden, Kathy, The Disappearing Russian Forest, Roman and Littlefield, London, 1988, pages 34 to 37

representing respectively 41 percent and 45 percent of the individual species groups total growing stock. Species of lesser importance account for 5 percent of the total volume or approximately one billion cubic meters with an indeterminate share in mature and over-mature volume.

Collective Farms

While government controlled forests dominate the forest fund (containing 98 percent of the forest land and stocked forest land) and thus dominate the distribution pattern of the total forest resource among the different species groups, collective farms follow a decidedly different pattern. Almost 12 million hectares or almost 60 percent of the area under collective farm jurisdiction is in either softwood deciduous species or hardwood deciduous species. Only 40 percent is under coniferous species. Coniferous species also account for 40 percent of the mature and over-mature land area of 2.3 million hectares in collective farms. The majority of the land area under mature and over-mature trees falls in the softwood deciduous species category, which contains 1.3 million hectares or 56 percent of the total.

While the distribution of growing stock under government management into the constituent species groups also reflect the pattern of the total growing stock of the forest fund, collective farms again follow a different pattern. Only 14 percent of coniferous species, 21 percent of softwood deciduous species and 10 percent of hardwood deciduous species are in the mature and over-mature age classes compared to 61 percent, 47 percent and 43 percent respectively in forests under management by government.

Growing Stock per Hectare

The average growing stock volume per hectare in mature and over-mature stands under control of collective farms is 166 cubic meters per hectare versus 136 cubic meters for forests under control of the various government organizations. Immature volume per hectare is 111 cubic meters for collective farms, while immature volume per hectare in government forests is 91 cubic meters. The higher inventories of growing stock on forests in collective farms reflects a number of factors which include more productive sites and fuller stocking arising from more intensive management made possible by integration with the agricultural orientation of the collective farm management authority.

Government Forests

Most of the land in the forest fund in government controlled forests is under the management of organizations belonging to the forest economy. These organizations primarily belong to *Goskomles* or the USSR State Committee for Forestry. The organizations account for over 700 million hectares, or over 90 percent of the stocked forest land and nearly 75 billion cubic meters, or nearly 90 percent of the standing volume.

Of this, 45 million hectares containing nearly 2.5 billion cubic meters have been set aside for long-term uses such as reindeer herding and hunting. The non-industrial use to which these forests are assigned reflects a low stocking per hectare of 76 cubic meters for mature and over-mature stands and 36 cubic meters for immature stands. This is far below the minimum economic stocking levels considered by some Soviet forest authorities to be at least 140 cubic meters per hectare.¹⁵ The average stocking per hectare in land (other than that allocated to long-term uses) administered by the forest authorities, in contrast, is 137 cubic meters in mature and over-mature stands and 90 cubic meters in immature stands.

Other (non *Goskomles*) ministries and organizations such as the Ministry of Defence, Agricultural Ministry, and various research institutes, schools, hospitals and sanitariums¹⁶ account for nearly 70 million hectares of stocked forest land and 8.8 billion cubic meters of growing stock. Of the area and volume allocated to other ministries and organizations, the former Ministry of the Timber Industry accounted for 23 million hectares of stocked forest land and 3.2 billion cubic meters of wood.¹⁷ Government farm forests account for 29 million hectares and 3.4 billion cubic meters of growing stock. Stocking is highest in forests of the former Timber Ministry where volumes per hectare in mature and over-mature stands are 202 cubic meters per hectare and 107 cubic meters in immature stands.

While nearly half of the forested land and almost 60 percent of the growing stock managed by government organizations are mature and over-mature, the age class distribution in forests managed by other ministries and organizations is quite

¹⁵The Global Forest Sector, Markku Kallio, Dennis Dykstra, and Clark Binkley, editors, pp. 703

¹⁶Forests of the USSR, Holowacz, J., The Forestry Chronicle, October 1985, page 368

¹⁷It is believed that management responsibilities have passed from the ministerial level to the individual associations and enterprises.

different. Government farms have the smallest share of stocked forest land and growing stock in the mature and over-mature age category of all government forests, amounting to 16 percent. Forests under jurisdiction of the timber industry are considerably higher containing 37 percent of the stocked forest land and 53 percent of the growing stock in this age category. Government forests which are not allocated to either government farm or timber industry organizations are similar to timber industry forests but have a lower share of growing stock in the mature and over-mature category.

Coniferous species account for a lower share of both stocked forest land and growing stock in forests managed by other ministries and organizations than forests managed by *Goskomles*. Conifers occupy 57 percent of the stocked forest land and 65 percent of the growing stock versus 72 percent and 80 percent for lands administered by *Goskomles*. Correspondingly, softwood deciduous species account for a higher share of stocked forest land and growing stock, 36 percent and 30 percent versus 15 percent and 15 percent. The difference is due to the large share of forest land under other ministerial management which is allocated to government farms, accounting for half of the area and more than 40 percent of the volume. Government farms have a similar distribution of species as that existing in collective farms.

The remaining forests in this group of management, containing 2.1 billion cubic meters of growing stock, 40 percent of which is mature and over-mature, support a higher volume per hectare than *Goskomles* forests in all species groups. The aggregate stocking per hectare is 157 cubic meters in mature and over-mature and 124 cubic meters in immature forests.

Land Under Control of The Forest Authorities

Slightly over one billion hectares of land in the forest fund is under control of organizations of the forest economy (also called the forest authorities) including that managed by the timber industry.¹⁸ Nearly 705 million hectares are stocked forest land, containing 75 billion cubic meters of wood. Almost 325 million hectares support

¹⁸The forests allocated to non-timber producing long-term use are under the administration of the forest authorities, but have no industrial significance. These forests are excluded in the following section summarizing the forest resource of the total Soviet Union. These lands are included only for the sub-sections dealing with site and stocking class. In order to understand which resource base is being discussed, constant attention should be placed on the footnotes.

45 billion cubic meters of mature and over-mature volume. The average inventory per hectare in mature and over-mature stands is 139 cubic meters while the average volume on immature stands is 90 cubic meters per hectare. Timber industry forests, believed to be located on better sites and having higher stocking classes, show stocking of 202 cubic meters per hectare in the mature and over-mature stands and 107 cubic meters in the immature age classes.

The Primary Use For Which The Land Is Intended - Forest Groups

The forests of the Soviet Union are managed for multiple-use. To facilitate their management, the forests have been divided into three categories of forest depending on their location and primary purpose.¹⁹

Group I forests have the greatest restrictions on use and are allocated mainly for protection of the environment. The uses include protection of streams and spawning areas, prevention of soil erosion, protection strips along main vehicular arteries, forests in little forested regions designed to provide general protection of the surrounding environment, forests around cities and industrial areas designed to improve air quality, forests for the general use of the urban population, forests set aside for national parks, production of nuts and berries, as well as pre tundra forests. A limited amount of harvesting is permitted in this category of forests, solely to facilitate the protection aspect of their use.

Group II forest, which have both protection and industrial importance, are located in densely populated areas with a well developed transportation network. A greater degree of management is necessary in these forests to guarantee the continued supply of both industrial products and environmental protection functions than is the case in Group III forests below. Collective farm forests are located in Groups I and II.²⁰ It is believed that government farm forests are located in Group I and Group II forests as well.

Group III forests are generally located in the well forested regions and are chiefly designated to provide a flow of wood to support the forest industry of the Soviet Union without causing damage to the makeup of those forests. One category within

¹⁹Lesnaya Entsiklopediya, Vol. 1, page 230

²⁰Lesnaya Entsiklopediya, Vol. 1, page 510

Group III forests is classified as reserve forests.²¹ Reserve forests have not yet been assigned to an industrial enterprise and are not expected to be economically developed for the next 15 to 20 years. The second category of Group III forests is called special zoned forests. It is not known for what reasons these forests have been set aside however. Probably, though not necessarily, the reasons stem from environmental factors. The balance of forests within Group III are considered to be operating forests presently developed or are expected to be developed within the course of the next two decades.²² Thus, reserve forests represent a store of wood volume which has yet to be allocated to any particular enterprise, and *ceteris paribus*, could be available for exploitation in the future. But, as discussed later, the volume of timber from such reserve forest lands could be more a mirage than reality.

Figure 8 shows that forest land occupies 807 million hectares of Soviet territory.²³ Stocked forest land accounts for 704 million hectares. Unstocked forest land represents 12 percent of forest land or nearly 99 million hectares. The remaining 5 million hectares are occupied first by immature plantations not yet old enough to be considered stocked, and second by nurseries and forest land set aside for other unspecified uses.

Figure 9 shows the distribution of unstocked forest land by type.²⁴ Nearly 58 million hectares or 58 percent of the total unstocked forest land of 99 million hectares are accounted for by small openings or glades in the forest canopy. Forest land which has been burned and does not yet support another crop of trees occupies 27 million hectares or 27 percent of the total unstocked forest land. Land unstocked following harvesting accounts for only 9 million hectares or 9 percent

²¹Lesnaya Entsiklopediya, Vol. 2, page 305

²²These forests have generally been assigned to individual forest enterprises for management and development. For example, an enterprise may have assigned to it a tract of land with an allowable annual cut (AAC) of 500 thousand cubic meters of wood; but at the present time only 150 thousand cubic meters can be harvested due to lack of major development roads (or access). The AAC difference represented by the 350 thousand cubic meters is considered "undeveloped"; but is expected to become available for harvest within the next 15 to 20 years at the current pace of infrastructural development.

²³Table C5 shows distribution of the forest land among the three groups of forests by category of forest land.

²⁴Table C6 presents the distribution of unstocked forest land among the four categories of unstocked segregated by group of forest.

SOVIET FOREST LAND UNDER FOREST ADMINISTRATION BY STOCKING

Ministry of Forestry and Forest Industry

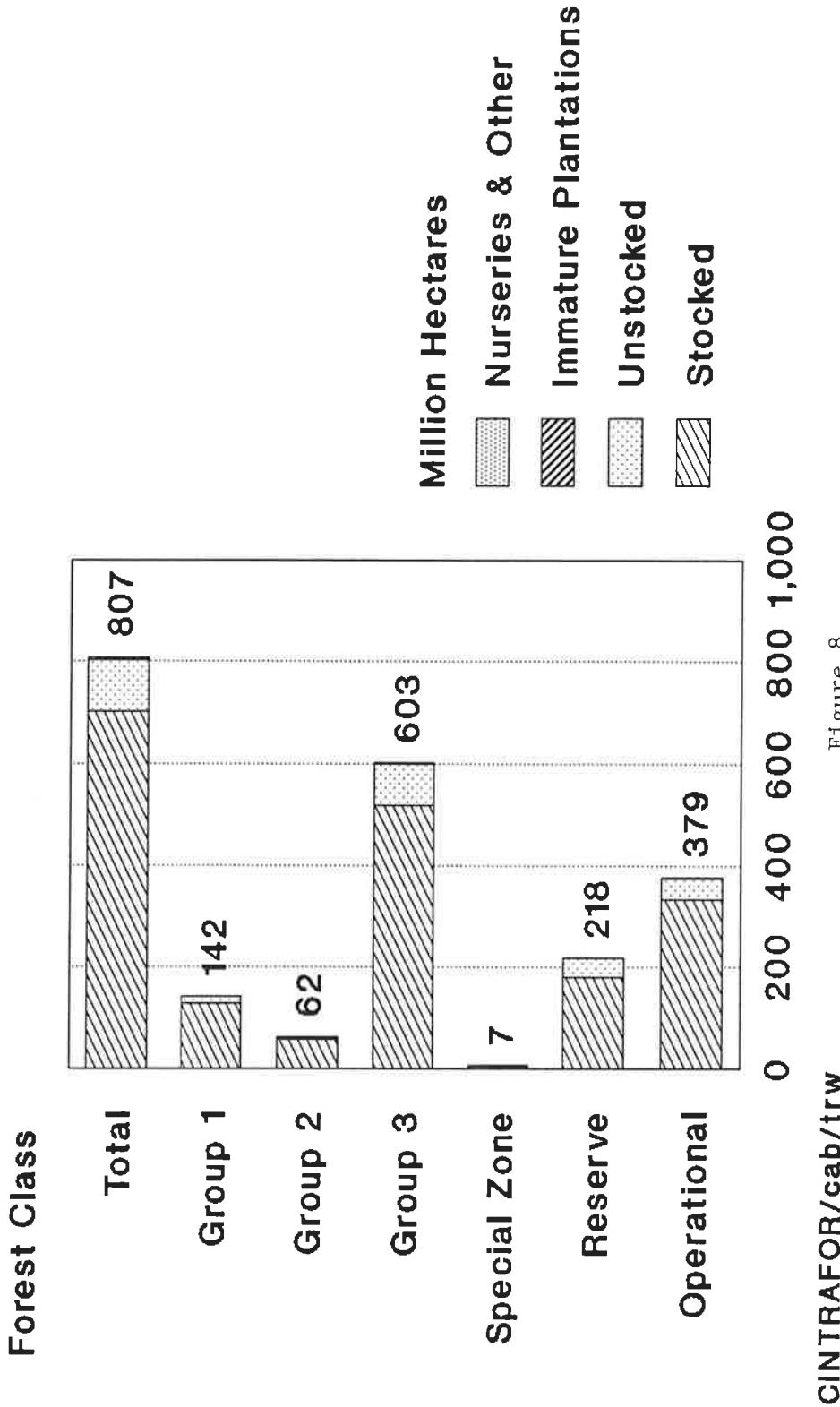


Figure 8

SOVIET UNSTOCKED FOREST UNDER FOREST ADMINISTRATION BY CONDITION

Ministry of Forestry and Forest Industry

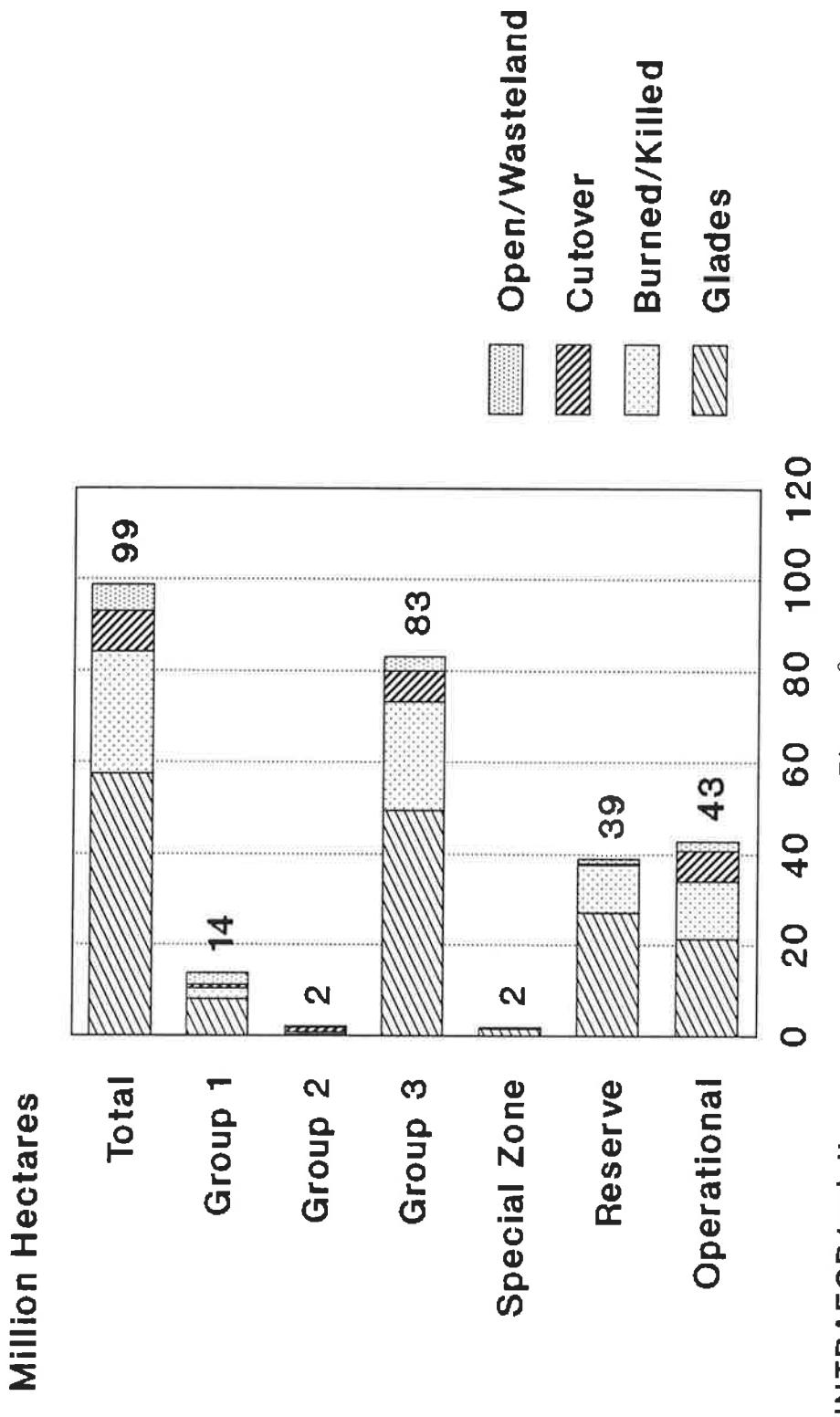


Figure 9

of the total. The remaining 6 million hectares (or 6 percent) consists of open wasteland. Of the nearly 800 million hectares of forest land, more than 140 million hectares, or just over 15 percent of the land, is located in Group I forests. Of this, nearly 130 million hectares, or 90 percent, is considered stocked forest land. Of the 14 million hectares which are unstocked, only 3 million hectares are classified as burned and cutover land which has yet to be satisfactorily restocked. Most of the unstocked forest land arises from glades and open wasteland which account for 8 million hectares and 2.6 million hectares respectively. Only 750 thousand hectares is currently unstocked due to harvesting activities.

Group II forests contain 62 million hectares of forest land of which 58 million hectares is stocked. Only 2 million hectares is currently unstocked and in need of forestry work. Nearly one million hectares (or slightly more than 50 percent of the total unstocked forest land) arises from harvesting. This land is currently awaiting reforestation. The balance, representing nearly 2 million hectares, is almost exclusively occupied by plantations not sufficiently old to be considered stocked forest land.

Group III forests contain slightly more than 600 million hectares of which almost 520 million hectares are considered stocked. Unstocked forest land comprises nearly 80 million hectares. Plantation stands represent only 4 million hectares of the nearly 520 million hectares of stocked forest land. Of the 80 million hectares of unstocked forest land, 24 million hectares arise from burned over stands which have yet to develop a stocked forest and 7 million hectares which are currently unsatisfactorily re-stocked following harvesting.²⁵

The standing volume of timber inventory in each of the three groups of forests follows quite closely the distribution of forest land. The stocked forest land and concomitant growing stock allocated to Group I forests are delineated in Tables C7 and C8. The forest resource allocated to Group II forests are shown in Tables C9 and C10. Tables C11 and C12 present the forest resource of forests allocated to Group III forests.

²⁵The higher share of unstocked forest land attributed to fires in Group III forests (28 percent versus 17 percent and 13 percent in Group I and II forests) is related to the location of most of the Group III forests in the Asian part of the country. Lack of infrastructure translates into a limited ability to suppress fires once they start. Often fires in this part (Asian) of the country are allowed to burn until extinguished by natural means. Group I and II forests are thought to have better access making initial attack and suppression more likely and possible.

Slightly more than 15 billion cubic meters of wood are growing in Group I forests representing 19 percent of the total volume. More than 5 billion cubic meters of wood are classified as mature or over-mature. Group II forests support 7 billion cubic meters, or 9 percent of the volume, while Group III forests support a volume of 57 billion cubic meters, or 73 percent of the total growing stock. Only 2.2 billion cubic meters of the Group II forest volume are mature and over-mature while almost 44 billion cubic meters of the volume in Group III forests are so classified. The average volume per hectare in mature and over-mature stands in Group I forests is 128 cubic meters, in Group II forests - 198 cubic meters per hectare, and in Group III forests - 139 cubic meters per hectare. Immature stands respectively support 123 cubic meters, 114 cubic meters, and 75 cubic meters per hectare.

Group II forests contain the smallest share of land which is unstocked and the largest share of plantations each amounting to 3 percent of the forest land. As mentioned above, Group II forests are industrial forests on which have been placed greater restrictions relating to the harvest of timber (due to the general proximity of these forests to developed sections of the country). Thus, it is not surprising to observe the highest share of forest land under plantations and the smallest share of forest land which is unstocked. Greater ease of access concomitant with higher site quality leads to better forest management.

Group I forests contain a higher degree of unstocked forest land than would perhaps be expected, approaching that which exists in Group III forests. However, nearly 60 percent of the unstocked forest land is accounted for by glades and 19 percent by general openings in the forest canopy. Group I forests are oriented towards providing environmental protection functions which can in fact be accomplished somewhat independent of the extent of standing forest. Harvesting in these forests is only permitted if it contributes to the accomplishment of the primary protection objectives. Thus, with openings or glades in the forest, ample vegetation is assumed to be present in the ground cover which negates the need to completely restock the land with tree species.

Group III forests contain the highest share of lands which are currently unstocked, amounting to 14 percent of the Group III forest land. Most of the unstocked forest land is accounted for by glades (or small openings in the canopy) and forest land which has

been burned. The Group III forests are generally located in less developed parts of the country which support lower site classes and thus have more open growing stands. The higher share of burned and dead stands is closely connected to the lack of infrastructure servicing much of the Group III forests²⁶. With poor access to much of the forested area, once a fire starts, there is little that can be done to quickly bring the fire under control in order to minimize the degree of damage.²⁷

Species

As shown in **Figures 10 and 11**, the dominant share of the forest resource is concentrated in coniferous species which account for 518 million hectares and 61 billion cubic meters of growing stock.^{28, 29} The primary coniferous specie is larch, which accounts for more than half of the coniferous area and volume and nearly 40 percent of the total stocked forest land area and growing stock of the Soviet Union. Larch is followed distantly by pine which contains 118 million hectares and nearly 15 billion cubic meters. Cedar pine accounts for 40 million hectares and 7 billion cubic meters, spruce accounts for nearly 80 million hectares and 11 billion cubic meters,

²⁶ Reserve forests, situated beyond the expected location of major transportation systems 15 to 20 years hence, account for 218 million hectares of forest land (of which 179 million hectares are considered stocked) of Group III forests. This category accounts for 35 percent of all stocked forest land in Group III forests.

²⁷ Since 1985, damage to stocked forest land has increased by more than three times to reach 1.6 million hectares in 1989 before falling to 1.4 million hectares in 1990. This is almost two thirds of the area clear cut on an annual basis. (*Lesnoye Khozaustvo*, page 92)

²⁸ Detailed information about the distribution of species and species groups is located in Tables C13 and C14.

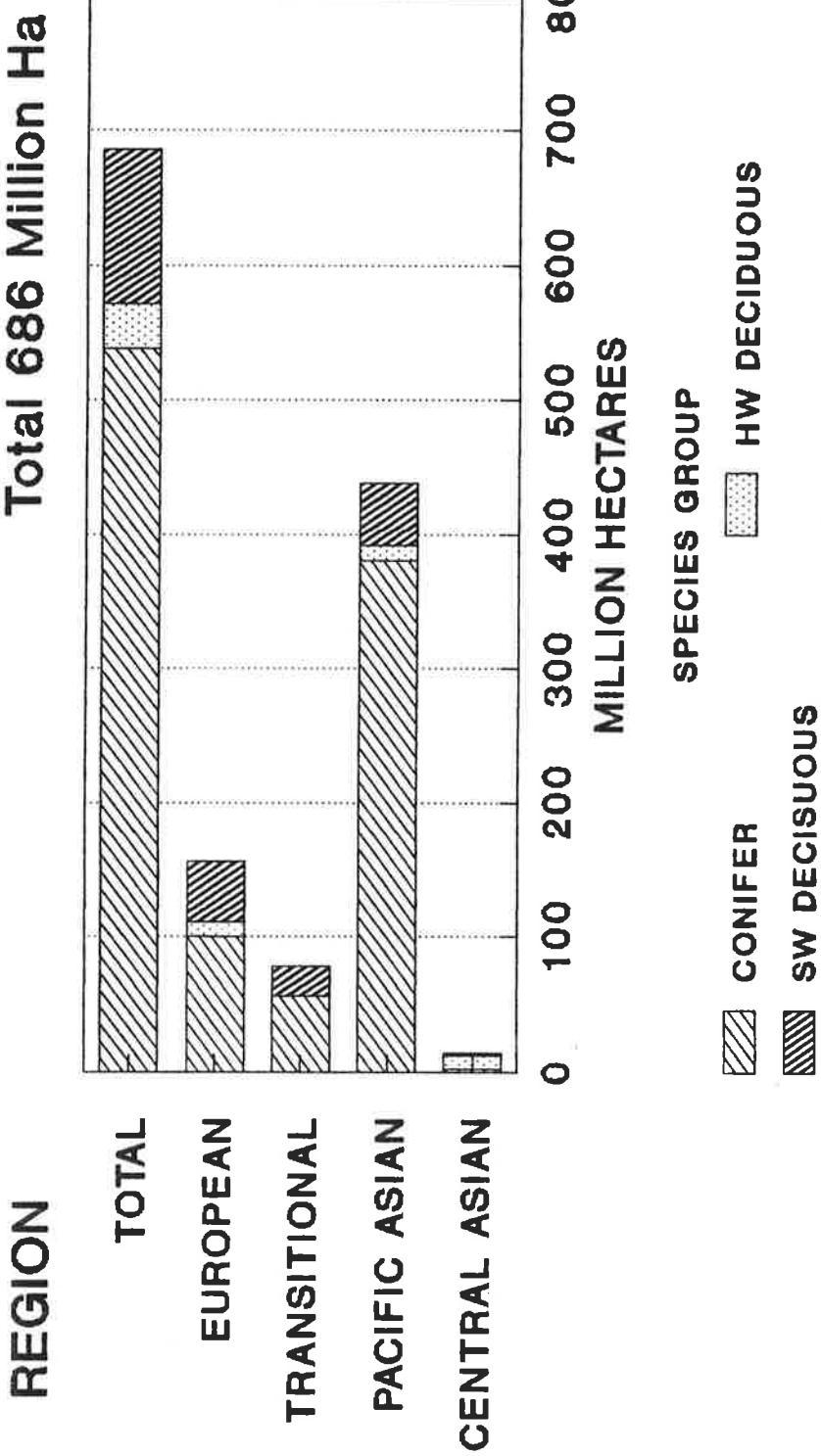
²⁹ Inventory data which segregates the forest resource into species and species groups is available from two sections within the forest fund statistical handbook. Both sources are restricted to the forest managed by either *Goskomles* or directly by the timber industry.

Source 1 provides detailed information about each group of forest at the country level of detail, and for forest groups combined at a Soviet Union, European USSR and Asian USSR level of detail. Source 1 excludes the forest resource which has been allocated to non timber producing long-term uses. It includes inventory data about tree species not included in one of the three main species groups.

Source 2 specifically includes forests allocated for long-term uses, but only examines the three species groups and species within the species groups. The other species, included in Source 1, are excluded in Source 2.

At the Soviet Union Level and European USSR level of aggregation, Source 1 is relied upon. At the Transitional RSFSR, Pacific Asian USSR, and Central Asian USSR level of detail, Source 2 is used. Source 2 is used because the greater level of detail available from Source 1 is not available for these three regional aggregations.

USSR STOCKED FOREST LANDS UNDER FOREST ADMINISTRATION BY REGION AND MAJOR SPECIES GROUP

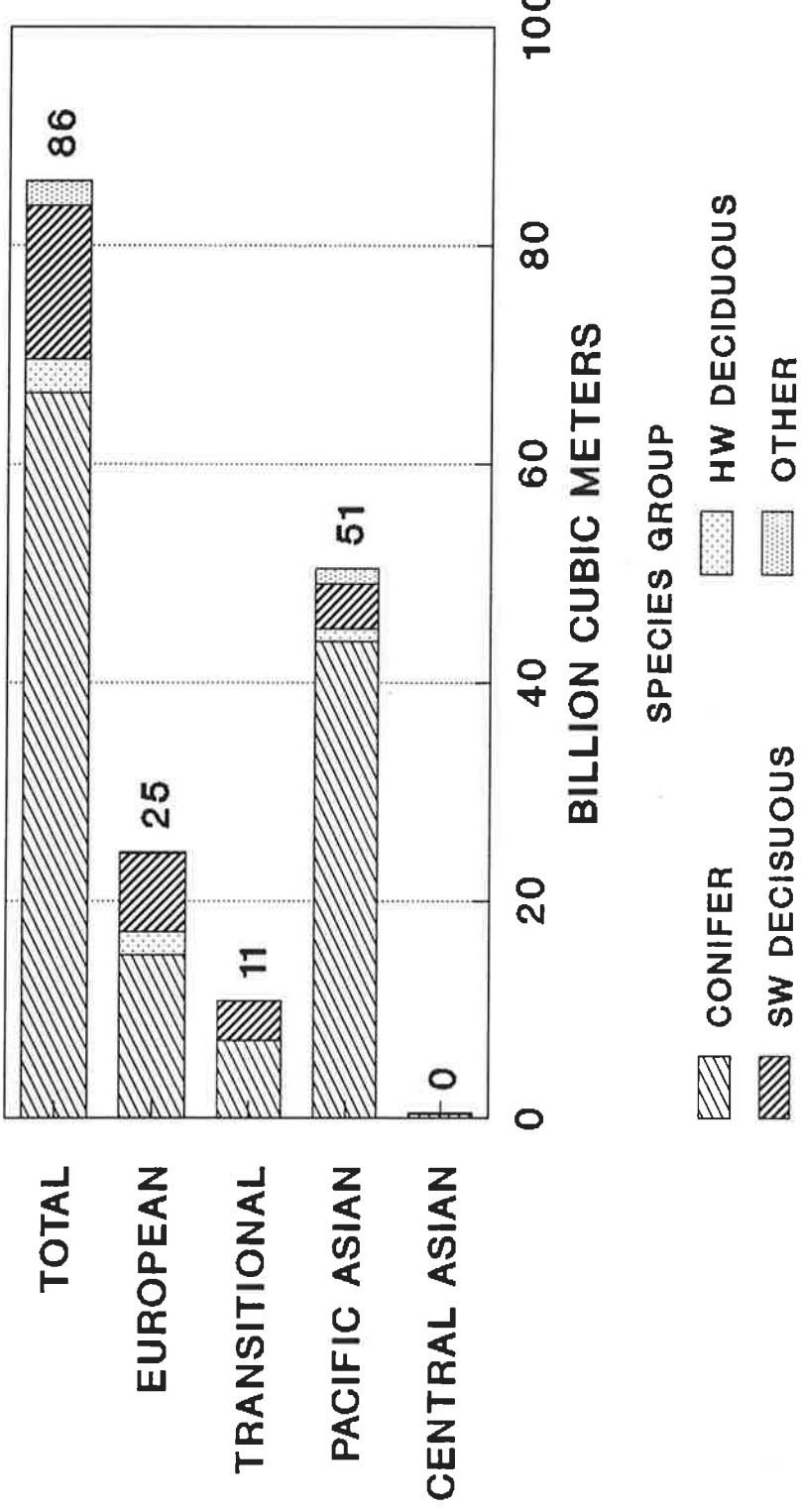


CINTRAFOR/cab/trw

Figure 10

USSR STOCKED FOREST GROWING STOCK BY REGION & MAJOR SPECIES GROUP

REGION



CINTRAFOR/cab/trw

Figure 11

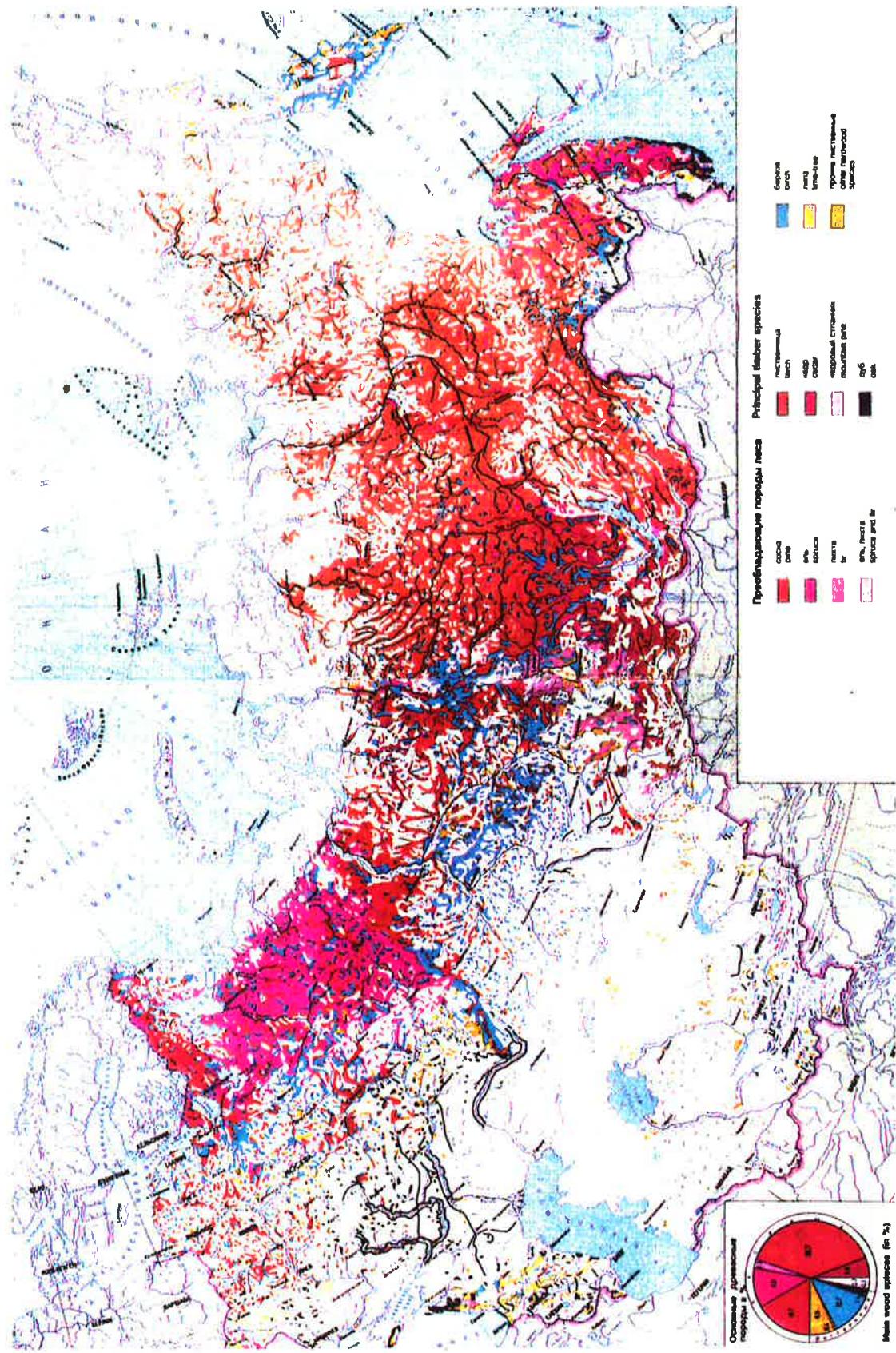
and true firs account for 16 million hectares and 3 billion cubic meters. Deciduous species collectively occupy 135 million hectares, or nearly 20 percent of the forested land, and 14 billion cubic meters, or nearly 20 percent of the growing stock. The predominant deciduous species are birch and aspen. Birch occupies 87 million hectares and 8 billion cubic meters while aspen accounts for 18 million hectares and 2.7 billion cubic meters of growing stock. Brush and other species of lower importance account for nearly 50 million hectares of forested land which supports less than one billion cubic meters.

Figure 12 shows the range of each principal species where the individual species dominates over all others.

In Group I forests, shown in Tables C7 and C8, where the greatest restrictions on harvesting are located, almost 70 percent of the area of 127 million hectares and 75 percent of the volume of 15.3 billion cubic meters are coniferous species. A disproportionately smaller share of larch and a correspondingly larger proportion of pine account for the largest part of this coniferous resource. Larch represents 27 percent of the area or 34 million hectares of the stocked forest land which support nearly 3 billion cubic meters or 18 percent of the growing stock. Pine accounts for 23 million hectares and 3.5 billion cubic meters of growing stock. Softwood deciduous species account for 18 percent of the forested area and 17 percent of the volume. Birch occupies 16 million hectares supporting 1.6 billion cubic meters accounting for the majority of this species group. Hardwood deciduous species account for 10 percent of the forested area and 9 percent of the volume with oak and beech together occupying 7.4 million hectares and containing 670 million cubic meters of growing stock, or more than 60 percent of the hardwood deciduous species total.

Group II forests, shown in Tables C9 and C10, include 58 million hectares of stocked forest land, coniferous species account for a disproportionately lower share of the forest resource. Only 56 percent of the area or 33 million hectares, and 59 percent of the volume or 4.4 billion cubic meters, are conifer species. Pine and spruce are the major components of the coniferous species contributing 2.4 billion cubic meters and 1.2 billion cubic meters on 19 million hectares and 8 million hectares of stocked forest land respectively. Larch, in comparison, grows on only 4 million hectares containing 532 million cubic meters of growing stock. Hardwood deciduous species account for 6 percent of the area and growing stock, less than in Group I forests. Oak

DISTRIBUTION OF THE MAJOR TREE SPECIES GROWING IN THE USSR



is the dominant species accounting for nearly all the hardwood deciduous species area and volume. Softwood deciduous species account for 36 percent of the forested area and 34 percent of the volume. As is expected, birch and aspen contribute more than 90 percent of the forest resource in this species group.

Group III forests, shown in Tables C11 and C12, are the most dominant group of forests in the forest fund, and contain the largest share of coniferous species. Conifers account for 77 percent of the area and 85 percent of the volume. Larch dwarfs the other coniferous species, accounting for 229 million hectares and 21 billion cubic meters of the 400 million hectares and 45 billion cubic meters under coniferous species. Pine and spruce collectively account for 25 percent of the area and 32 percent of the volume. Hardwood deciduous species account for a negligible share of the forest resource in Group III forests. Softwood deciduous species occupy nearly 70 million hectares and 6.6 billion cubic meters of the 518 million hectares and 53 billion cubic meters in Group III forests. Birch dominates this species group by accounting for nearly 57 million hectares and 5 billion cubic meters.

Site Class

Slightly more than 685 million hectares of forest land (including that allocated to long-term uses but excluding tree species not included in one of the three main species groups) are classified as stocked forest land under the administration by either *Goskomles* or timber industry organizations.³⁰ This resource base supports the major forest species. The forest land is divided into five site classes ranging from 1 (the highest site) down to 5 (the lowest site). In addition to the five site classes, there are two gradations beyond site class 1 and two gradations below site class 5. In the Soviet literature, subscripts a and b denote the sub classes. Thus, site classes 1a and 1b would denote forest land which has an even higher site quality than that depicted by site class 1. Correspondingly, site classes 5a and 5b denote site classes which are even poorer than those classified as 5. Site class 5b is a lower site class than 5a. Correspondingly, site class 1b is higher site class than 1a.³¹

³⁰Site class information is available only for 685 million hectares containing (from the Soviet viewpoint) the principal species, located on the combined stocked forest land of Groups I, II, and III forests and forests allocated for non timber producing long-term uses. All of these forests are administered by either *Goskomles* or timber industry organizations.

³¹Atrokhin, V. G. and Kuznetsov, G.V., *Lesovodstvo*, page 126

Inventory data presented in Figure 13 segregates the stocked forest land into five site class categories: site class 2 and above, site classes 3, 4, and 5, and site classes 5a and lower.³² The highest site class category, site 2 and above, contains nearly 80 million hectares of stocked forest land or 11 percent of the Soviet total. Site classes 3, 4, and 5 contain each between 165 million and 180 million hectares, or collectively 75 percent of the stocked forest land of the USSR. Stands of site class 5a and lower contain nearly 100 million hectares or 14 percent of the total stocked forest land area.

Forests with a site class of 5a and lower are not considered adequate to support a commercial forest stand.³³ Thus, forest land, presently stocked, which is considered to meet the minimum site class requirements for industrial potential (including reserve forests and special zoned forests in Groups II and III forests, as well as forests allocated to long-term uses), amounts to 590 million hectares. Coniferous species account for 452 million hectares, 30 million hectares are hardwood deciduous species, and 108 million hectares are softwood deciduous species.³⁴

Deciduous species occupy a disproportionate higher share of the better sites. While representing just 22 percent of the stocked forest land, deciduous species account for 54 percent of the highest site category and 28 percent of site class 3 forests. Nearly 60 percent of deciduous stands are in site class 3 and above. For coniferous species, on the other hand, only 31 percent are in site classes 3 and higher.

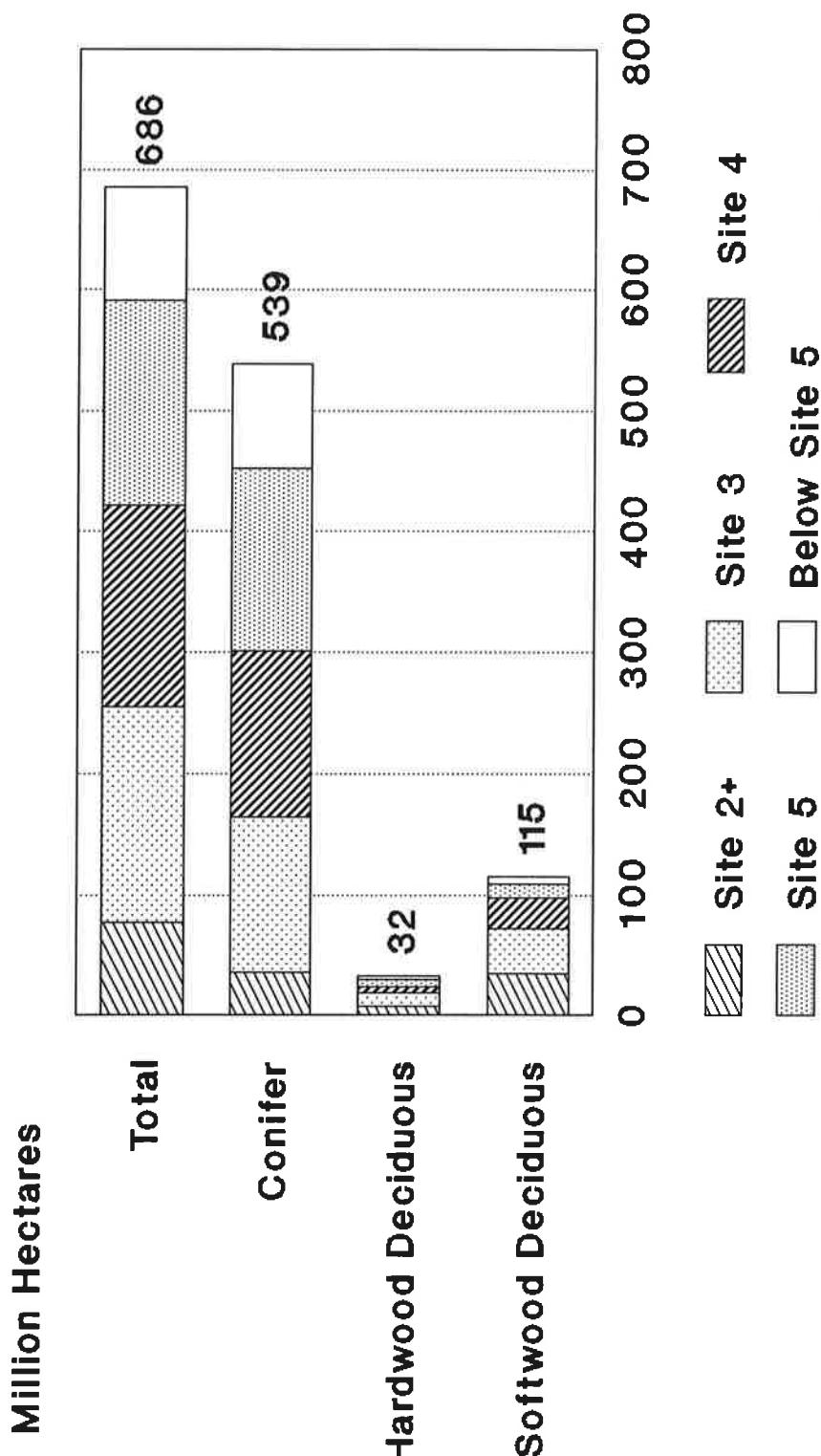
Correspondingly, the lower site classes have a significantly higher proportion of coniferous species which increase in share as the site class decreases. Less than 50 percent of the forest land in site class 2 and higher are conifers. Coniferous species occupy 72 percent of the total site class 3 lands. For the lowest site class (site classes 5a and lower), the ratio rises even more. Over 90 percent of the land is occupied by coniferous species and only 9 percent with deciduous species. The result is not surprising since the broad distribution of site classes is correlated with

³²Detailed information about the distribution of stocked forest land is delineated in Table C15.

³³Lesnaya Entsiklopediya, Vol. 2, page 403

³⁴The Soviets do not consider all potential land as exploitable discussed later in this report. In fact, only 406 million hectares are so viewed.

**SOVIET STOCKED FOREST LANDS UNDER
FOREST ADMINISTRATION BY SPECIES & SITE**
Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 13

climatic conditions. Poorer sites are generally located in colder regions in which coniferous species are better suited for survival.³⁵

While site class information segregated by forest group or individual species is not available, it is believed that larch occupies a disproportionate higher share of the lower sites because of the geographic distribution of this species throughout the USSR. It is concentrated in the Asian part of the country which is characterized by severe climatic conditions and the existence of permafrost over much of this region.

Site quality information for the forest resource includes forests allocated to non-timber producing long-term uses. Stocked forest land (included in the three major species groups) contained in forests allocated for long-term use amounts to 32 million hectares and supports 1.9 billion cubic meters. Forests allocated for long-term uses are thought to be concentrated in the lowest site classes.³⁶ Thus, in netting out the site classes 5a and below to arrive at the stocked forest land which meets the threshold site class to be considered for industrial harvesting activity, long-term use forests are also thought to be nearly completely netted out.

Stocking Class

While the Soviet Union contains significant forest resources, not all of the forest land supports the maximum growing stock of wood.³⁷ Figure 14 divides the forest inventory into three categories based on the degree of stocking.³⁸ Stands are considered fully stocked when there is 100 percent crown closure.³⁹ Stands under

³⁵A more complete discussion of the location of vegetation zones in the USSR and the effect of temperature on the distribution of tree species is contained in Appendix A.

³⁶This is evident in the average stocking for forests set aside for long-term uses, in which the stocking is 60 cubic meters per hectare. The remaining forests managed by either *Goskomles* or directly by the forest industry have average stocking of 114 cubic meters per hectare.

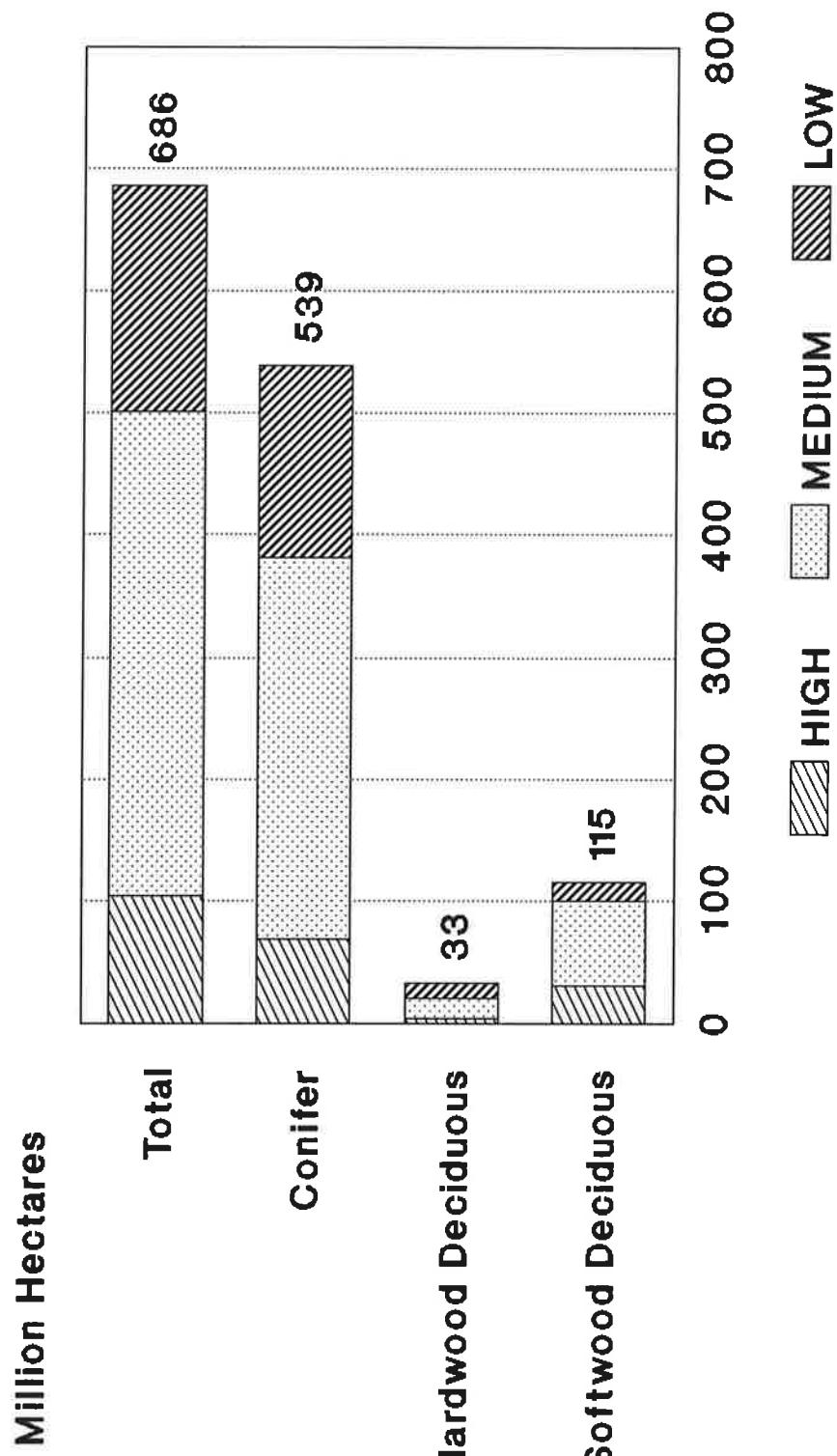
³⁷The discussion about stocking class includes the same land area about which the section on site class is based.

³⁸Table C16 shows the detailed distribution of stocked forest land among the three stocking classes.

³⁹There is another criterion used to determine the degree of stocking. Apparently, stocking is also based on the extent to which the basal area of the stand currently occupying the site approaches that which is considered the normal basal area. Thus, if the current stand had a basal area 80 percent of the normal, it would be classified as having a stocking class of 0.8.

SOVIET STOCKED FOREST LANDS UNDER FOREST ADMIN BY SPECIES & STOCKING

Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 14

these conditions are given a stocking class of 1.0. Stands in the Soviet Union are considered stocked when crown closure is greater than 30 percent.⁴⁰

The stocking classes are defined as high, medium, and low stocking, which incorporate the range of stocking between 30 percent and 100 percent. The high stocking class corresponds to crown closure of between 80 and 100 percent. The medium stocking class corresponds to crown closure of between 50 and 70 percent. The low stocking class corresponds to between .30 and 40 percent.

Nearly 100 million hectares of the total 685 million hectares of stocked forest land have been classified as having high stocking. Four hundred million hectares (or nearly 60 percent) of the stocked forest land have average stocking. Fully 180 million hectares or nearly 30 percent of the stocked forest land is considered as having the minimum stocking levels. As can be expected for softwood deciduous species, nearly 90 percent of this specie group are in stands with a stocking class of high or medium. A lower share of the stocked forest land supporting hardwood deciduous species is located in these two classes of stocking. It is believed that this is due to the higher share of these tree species located in mountain forests.⁴¹ Most of the coniferous stocked forest land lies in the medium stocking class which contains nearly 60 percent or 313 million hectares of the coniferous stocked land. Only 13 percent of land supporting coniferous species are in the high stocking class.

Nearly all of the stocked forest land in site classes 5a and lower is located in the low and medium stocking classes. Only 6 million hectares are located in the high stocking class. Thus, stocked forest land, after removing the lowest site class land, which meets the thresh hold site class necessary for potential industrial development, consists of 98 million hectares of forested land having high stocking, 350 million hectares having medium stocking, and 143 million hectares having low stocking.

⁴⁰Holowacz, J., The Forests of the Soviet Union, The Forestry Chronicle, October, 1985, pp. 367

⁴¹Refer to the section following entitled, "Mountain Forests".

Age Classes

The Soviet forest resource is divided into six age classes including two categories of young stands (which already have achieved the minimum crown closure), middle aged, approaching mature, mature, and over-mature stands.⁴² Age at which middle aged category is achieved occurs at between 40 and 60 for coniferous and hardwood deciduous tree species and at between 20 and 30 for softwood deciduous species. The approaching mature age class starts when trees reach between 80 and 100 years for conifers and hardwood deciduous tree species and between 50 and 60 years for softwood deciduous species. Maturity is reached when coniferous species attain an age of between 80 and 140 and hardwood deciduous species attain an age of between 80 and 140. Softwood deciduous species reach maturity at ages of 40 to 70. The onset of over maturity is generally considered to occur in conifers when age is between 100 and 140. In softwood deciduous species, the onset of over-maturity takes place at the age of between 50 and 70. The onset of over-maturity in hardwood deciduous species seems to occur much later.⁴³

While there are six age classes which describe the forest resource, Soviet inventory data segregates the resource into only 5 classes - the mature and over-mature age classes are combined.

As is shown in **Figure 15**, nearly 50 percent of the stocked forest land, or 323 million hectares, is located in mature and over-mature forests.^{44, 45} Coniferous species contain somewhat older age structure with 54 percent of the forested land in

⁴²Age class information which segregates the inventory into the six age class categories is available only for the stocked forest land and growing stock which is managed by either *Goskomles* or the timber industry directly and excludes the forests allocated for non timber producing long-term uses. This is different from the land base utilized for the discussion about site class and stocking class.

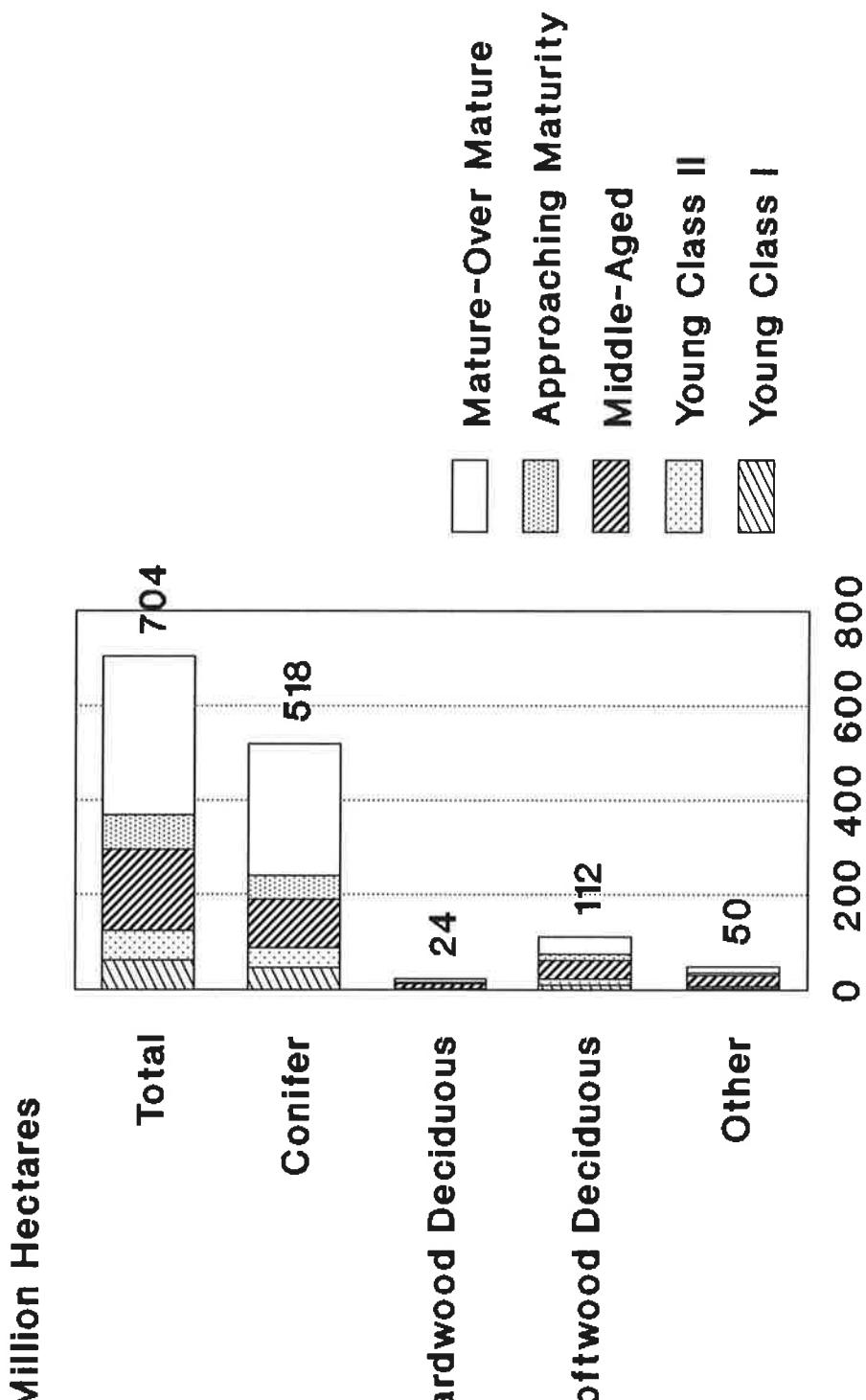
⁴³Over-maturity occurs in pine stands at an age of between 120 and 140 and in spruce stands at an age of between 100 and 120. In softwood deciduous species of birch, over-maturity occurs between the ages of 60 and 70 and in aspen between the ages of 50 and 60. Over-maturity in oak, a hardwood deciduous species, occurs after age 180. (*Lesnaya Entsiklopediya*, Vol. 2, page 202)

⁴⁴Data about the area of the forest resource and not volume is thought to be a better indicator of future importance of individual species and species groups. While volume is time and thus age class dependent, area is thought to be relatively independent of time.

⁴⁵Table C13 shows in greater detail distribution of stocked forest land among the different age classes.

SOVIET STOCKED FOREST LANDS UNDER FOREST ADMINISTRATION BY SPECIES & AGE

Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 15

the mature and over-mature age category. Deciduous forests are not nearly as old. Softwood deciduous species contain 37 million hectares of mature and over-mature timber (or 33 percent of the area) while hardwood deciduous species contain 8 million hectares (or 35 percent of the area) in stands classified as mature and over-mature.

Even though larch represents 45 percent of the area of stocked forest land in the mature and over-mature age classes, it only accounts for between 29 and 33 percent in the immature age classes. Pine, the next most dominant specie in immature stands, accounts for between 16 percent and 27 percent of the immature stocked forest land. Only 14 percent of the stocked forest land allocated to pine species are mature and over-mature. Spruce, the second most dominant species in the mature and over-mature age category, while containing 16 percent of the forested land in this age category, only accounts for between 4 and 12 percent of immature age classes.

Hardwood deciduous species account for less than 5 percent of the stocked forest land. Softwood deciduous species, on the other hand, contain 11 percent of the mature and over-mature stocked forest land , and between 18 percent and 22 percent of the area in each of the four immature age classes. Birch accounts for two-thirds of the mature and over-mature stands containing the principal softwood deciduous species. Aspen accounts for the rest. While the share of aspen in the immature age classes does not exceed the 2-4 percent range, birch increases from 8 percent of the mature and over-mature stocked forest land to between 14 percent and 19 percent in the immature age classes.

As can be expected, the general pattern masks the variation which exists within each of the forest Groups I, II, and III. Tables C7, C9, and C11 show the distribution of forested land segregated by group of forest.

While nearly 40 percent of the stocked forest land of Group I forest (Table C7) is mature or over-mature, this age class category accounts for almost 50 percent of the coniferous species, 22 percent of the hardwood deciduous species and 28 percent of the softwood deciduous species. Most of the area in the immature stands consist of pine and larch which account for 23 percent and 15 percent respectively of the total immature stocked forest land. Spruce accounts for only 7 percent. This is somewhat different than what occurs in the mature age classes where larch, spruce, and pine dominate. Larch accounts for 43 percent, spruce for 19 percent, and pine for eleven

percent.⁴⁶ Thus, a shift in the future towards pine and away from larch and spruce is to be expected, and in the short run, a possible increase in the share of Korean pine.

While a shift in species importance within the deciduous species groups is unlikely, in the future, a move away from coniferous species can be expected as the share of this species group in the area of the four immature age classes is less than the conifer share in the mature age classes. The opposite can be expected for the deciduous species groups, where the share is considerably higher in each of the immature age classes. In the youngest two age classes, the share of coniferous species again rises though not to the same level as presently experienced in the mature and over-mature age class. Thus, assuming proper forest management techniques which discourage colonization of cleared forest land with deciduous species, the coniferous species can be expected to reassert themselves at a distant future date.

Group II forests (Table C9) contain the smallest share of stands in the mature and over-mature age classes, accounting for only 20 percent of the stocked forest land. The principal species in the mature and over-mature area are pine, spruce, and larch, which occupy 21 percent, 19 percent, and 15 percent of the land respectively. In the immature age classes, however, pine and spruce dominate, occupying 36 percent and 13 percent of the stocked forest land. Larch occupies 5 percent. Thus in the future, a shift away from larch to pine can be expected for Group II forests.

The importance of coniferous species can be expected to rise after an initial decrease. In the youngest age classes, coniferous species account for 71 percent and 63 percent of the area versus 5 percent and 7 percent for hardwood deciduous species and 23 percent and 29 percent for softwood deciduous species. In the oldest two immature age classes, coniferous species account for 43 percent and 56 percent of the area versus 7 percent and 6 percent for hardwood deciduous species and 48 percent and 38 percent for softwood deciduous species. All of the short term increase in the size of the softwood deciduous species occurs with birch. The share of birch rises from 20 percent in the mature and over-mature age category to between 25 and 37 percent in the oldest two immature age classes.

⁴⁶Interestingly, Korean pine, while containing only 4 percent of the stocked forest land in the mature and over-mature category, accounts for 12 percent of the two oldest immature age classes.

Group III forests (Table C11) have the largest share of stands in the mature age classes accounting for 52 percent of the stocked forest land. Hardwood deciduous species have the oldest age structure with the mature age classes accounting for 69 percent of the stocked forest land. Coniferous species are next which include 57 percent followed by softwood deciduous species which contain only 39 percent of the forested area in mature and over-mature age classes. Larch is the dominant specie in all age classes accounting for 36 to 47 percent of the total stocked forest land. While spruce and pine contribute 15 and 14 percent of the area in mature and over-mature stands, spruce is underrepresented in the immature age classes where it consistently occupies less than 6 percent of the forested area except for the youngest age class where it occupies 10 percent. Pine accounts for between 13 percent and 22 percent of the immature age classes. Birch dominates in the softwood deciduous species group. Hardwood deciduous species are only nominally represented.

Some changes in the species components of Group III forests can be expected in light of the distribution of stocked forest land segregated into age classes and species. A gradual replacement of spruce with pine within the coniferous species group and replacement of brush with species from one of the three species groups can be expected. In the short term, coniferous species will be replaced by softwood deciduous species, primarily birch. In the long run, coniferous species are expected to regain their dominant share as the present younger stand structure matures.

Mountain Forests

Almost 470 million hectares of forest land are classified as mountain forests.⁴⁷ Slightly over 400 million hectares of mountain forests are located in Groups I, II, and III forests (believed to be solely under management of the forest authorities). The balance, nearly 70 million hectares (25 million hectares classified as stocked forest land and supporting 1.6 billion cubic meters), has been allocated to other long term uses such as reindeer herding and hunting which do not include industrial use by the forest industry. Thus, as Tables C17 and C18 show, mountain forests in Groups I, II, and III, accounting for 91 percent of the stocked mountain forest land and 95 percent of the growing stock, contain 273 million hectares of stocked forest land which

⁴⁷ Mountain forests grow within the mountain regions where relative elevation differences are greater than 100 meters or an average slope surface from lowlands to the mountain top or to the tree line is greater than 5 degrees. Gorniye Lesa, Sinitina, S. G., page 6

support nearly 30 billion cubic meters of growing stock. The balance is accounted for by mountain forests allocated to long-term uses.

Nearly 80 percent of the mountain forested area and more than 70 percent of the mountain forest inventory volume are located in Group III forests. Group II forests contain the smallest share (5 percent) of the area and (7 percent) of the inventory volume. Group I forests contain 16 percent of the area and almost 20 percent of the volume. Almost 80 percent of the mature and over-mature volume in mountain forests is located in Group III forests. Group II forests contain 5 percent while Group I forests contain 15 percent of mature-overmature inventory.

As **Figure 16** shows, nearly 70 percent of the mountain stocked forest land is occupied by coniferous species. Larch accounts for 43 percent, spruce and fir - 12 percent and pine - 7 percent of the stocked forest land. Hardwood deciduous species occupy 6 percent of the stocked forest land while softwood deciduous species occupy 12 percent. Bush and other species account for the remaining 12 percent.

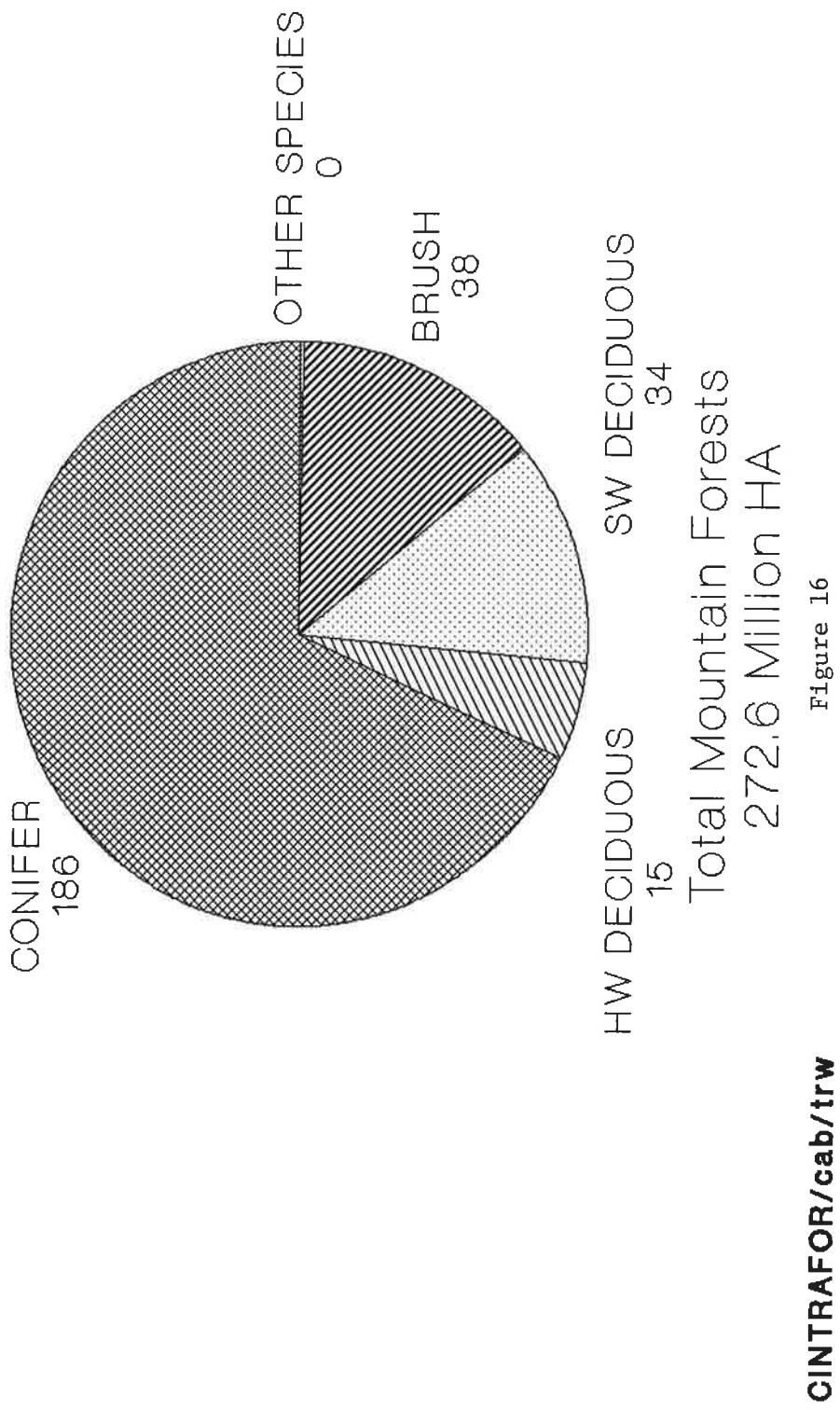
Mountain forests contain a significant share of the timber resources of the Soviet Union as indicated in Tables C19 and C20. More than 35 percent of the 704 million hectares of stocked forest land and 76 billion cubic meters of growing stock in the USSR are contained in mountain forests.⁴⁸ About 43 percent of the 323 million hectares of mature and over-mature forests and 35 percent of the 45 billion cubic meters of the mature and over-mature growing stock are located in mountain forests. Mountain forests also account for 43 percent and 37 percent of the total stocked forest land and corresponding growing stock of Group I forests, 27 percent and 30 percent of Group II forests and 64 percent and 39 percent of Group III forests. **Figure 17** shows the distribution of stocked forest land by mountain and non-mountain forest categories.

While nearly 53 percent of the coniferous species in the forest fund are mature and over-mature forests, 63 percent of this species group in mountain forests falls into these age classes. More than 10 percent are in the approaching maturity age class while 16 percent are in middle age category. The remainder fall into the younger age

⁴⁸Volume and area, excluding forests allocated to long-term uses, are under the management of either the forestry administration or the forest industry.

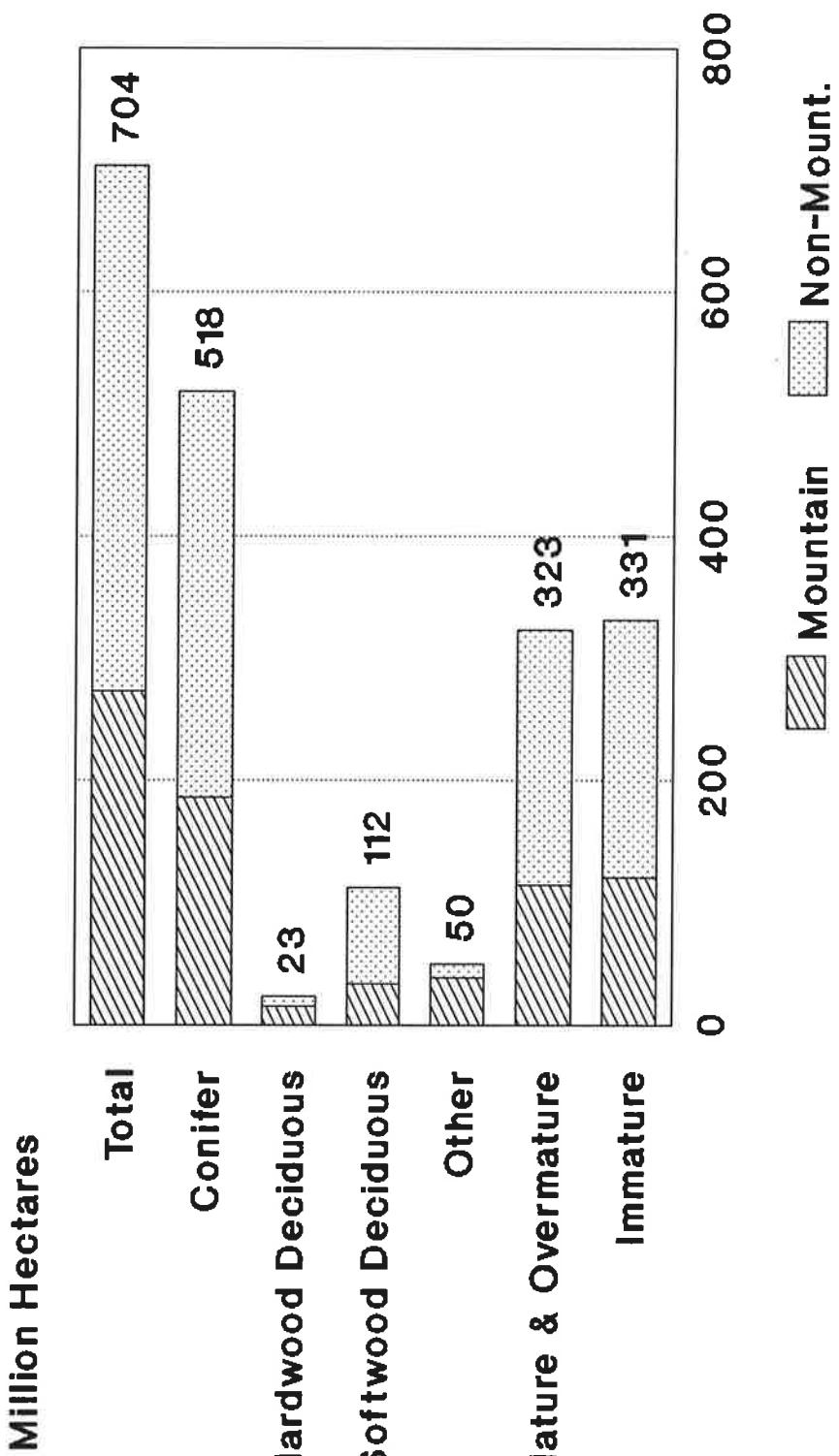
AVAILABLE SOVIET MOUNTAIN FORESTS

All Forest Groups & Major Species (Excluding Non-Timber Uses)



SOVIET STOCKED FOREST LANDS UNDER FOREST ADMINISTRATION BY SPECIES GROUP

Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 17

classes. Fifty percent of the hardwood deciduous species are mature or over-mature, with 12 percent in the approaching maturity age class. Some 25 percent of the mountain forested land are in softwood deciduous species. Almost 37 percent of this species group are mature and over-mature, 12 percent are approaching maturity while 27 percent are in the middle age category.

Of the 17 billion cubic meters of mature and over-mature wood in mountain forest, 15 billion cubic meters are the coniferous species.⁴⁹ Nearly 8 billion cubic meters are larch, 4 billion cubic meters are spruce and true fir, and nearly 2 billion cubic meters are cedar pine. Almost one billion cubic meters are hardwood deciduous species of which 400 million cubic meters are stone birch and 350 million cubic meters are oak, beech and ash. Softwood deciduous species contain almost one and a half billion cubic meters of inventory, of which 778 million cubic meters are birch and 123 million cubic meters are aspen.

Accessibility

Stocked forests which could be managed for the production of timber by either *Goskomles* or timber industry organizations account for 703 million hectares of the 803 million hectares of forest land.⁵⁰ Forests which are believed to be beyond the limits of major transportation systems expected to be completed within the course of the next 15 to 20 years are classified as reserve forests. This category of forests amounts to 218 million hectares of forest land and 179 million hectares of stocked forest land. All reserve forests are located in Group III forests.

In addition to reserve forests in Group III forests, parts of Group II and Group III forests are specifically identified as having special but unspecified uses. Of the 62 million hectares of forest land and 58 million hectares of stocked forest land in Group II forests, the more restricted lands accounts for only 1.3 million hectares and 1.2 million hectares respectively. Special forests in Group III forests amount to 18 million hectares of land, but only 6.5 million hectares of forest land and 4.7 million hectares of stocked forest land.

⁴⁹ Growing stock for the individual species is based on the 1978 inventory and not the 1988 inventory. The species specific information was obtained from *Gorniye Lesa* page 22.

⁵⁰ These figures excludes forests allocated for long-term uses.

Figure 18 shows that the mature and over-mature growing stock located in reserve and inaccessible forests amounts to nearly 23 billion cubic meters.^{51, 52} Nearly 85 percent of this is located on Group III forests. Only 243 million cubic meters or one percent is located in Group II forests. The remainder, 3 billion cubic meters, accounting for 14 percent, is located in Group I forests. Coniferous species account for the majority of the overall total volume, amounting to 93 percent of the growing stock. The share of coniferous species is highest in Group III forests where it represents 95 percent of the volume and lowest in Group II forests where it accounts for 76 percent. In Group I forests, it accounts for nearly 85 percent of the inventory volume.

The total area where timber harvest could be possible in the near to medium term (up to 20 years) in Group III forests appears to be about 334 million hectares. Another 57 million hectares in Group II forests are available for timber harvest on a somewhat more restricted basis. Harvesting is possible from the 127 million hectares of Group I Forests but on a very restricted basis.⁵³ Thus the sum total is 518 million hectares. This total, however, includes at least 68 million hectares of lower site classes (5a and below)⁵⁴. In addition, there are 49 million hectares of stocked forest land supporting species which are not included in one of the three principal species groups.

Nearly one-third of reserve forests (about 60 million hectares) are located in site classes below 5.⁵⁵ Most of this (approximately 40 million hectares) are thought accounted for by the species not expressly identified with the three main species groups. The balance is considered to be low site class land. Therefore, nearly 20

⁵¹Detailed information about the mature and over mature growing stock is contained in Table C24.

⁵²The effective date of the inventory from which the reserve and inaccessible information is derived appears to be 1978. Comparable information derived from the most recent inventory of 1988 is not available.

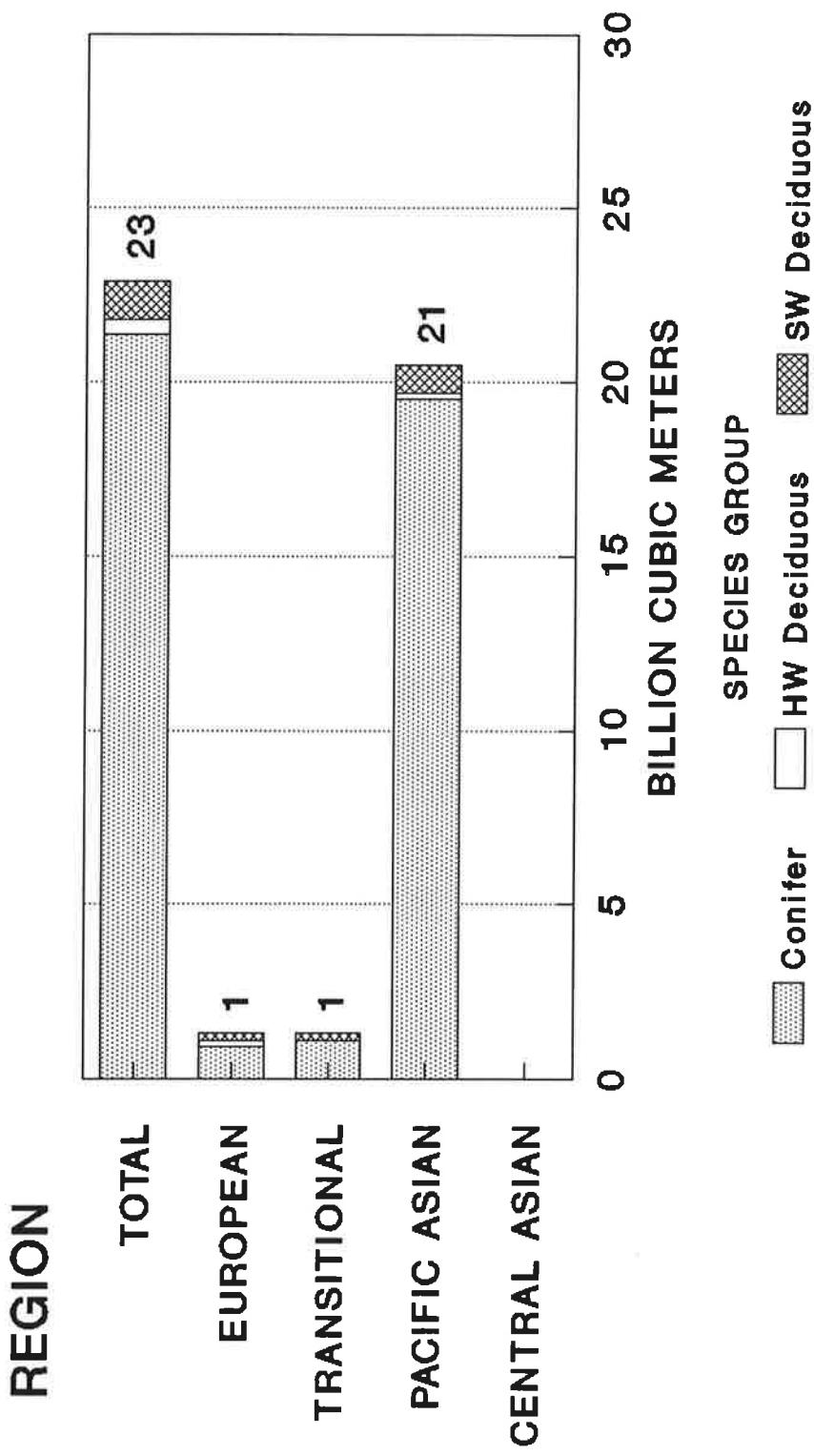
⁵³Of the actual harvest of 331 million cubic meters from clear cutting and forest improvement cuttings in 1989, 27 million cubic meters came from Group I forests, 82 million cubic meters from Group II forests, and 223 million cubic meters came from Group III forests. (*Lesnoye Khozaustvo*, page 55)

⁵⁴Site class information includes 46 million hectares of stocked forest land allocated to long-term uses. The principal species occupy 32 million hectares. Most is thought to be included in site classes 5a and below. Thus, the level of stocked forest land with a site class of 5a and below in the stocked forest land managed by organs of the forest economy for timber production is 68 million hectares (100 million less 32 million).

⁵⁵*Lesnaya Entsiklopediya*, Vol. 2, page 305

USSR RESERVE/INACCESSIBLE MATURE TIMBER FOREST ADMINISTRATION BY REGION/SPECIES

(Ministry of Forestry & Forest Industry)



CINTRAFOR/cab/trw

Figure 18

million hectares of the 68 million hectares of the lower site class lands are factored out when reserve forests are subtracted. Thus nearly 48 million hectares should be subtracted from the land base due to low site productivity, and 10 million hectares subtracted to account for the remaining non-economic species to generate the stocked forest land where timber harvest could be possible in the near to medium term, equal to approximately 460 million hectares.

While an estimated 460 million hectares are potentially available for industrial development in the near to medium term, the Soviets believe that much less is available for exploitation.⁵⁶ Of the 406 million hectares and 50 billion cubic meters considered exploitable by the Soviets, 78 million hectares and 9 billion cubic meters are located in Group I forests, 53 million hectares and 7 billion cubic meters are located in Group II forests, and 275 million hectares and 34 billion cubic meters are located in Group III forests. This realistically exploitable forest managed by the forest authorities is believed to have supported an AAC of about 625 million cubic meters in 1989.

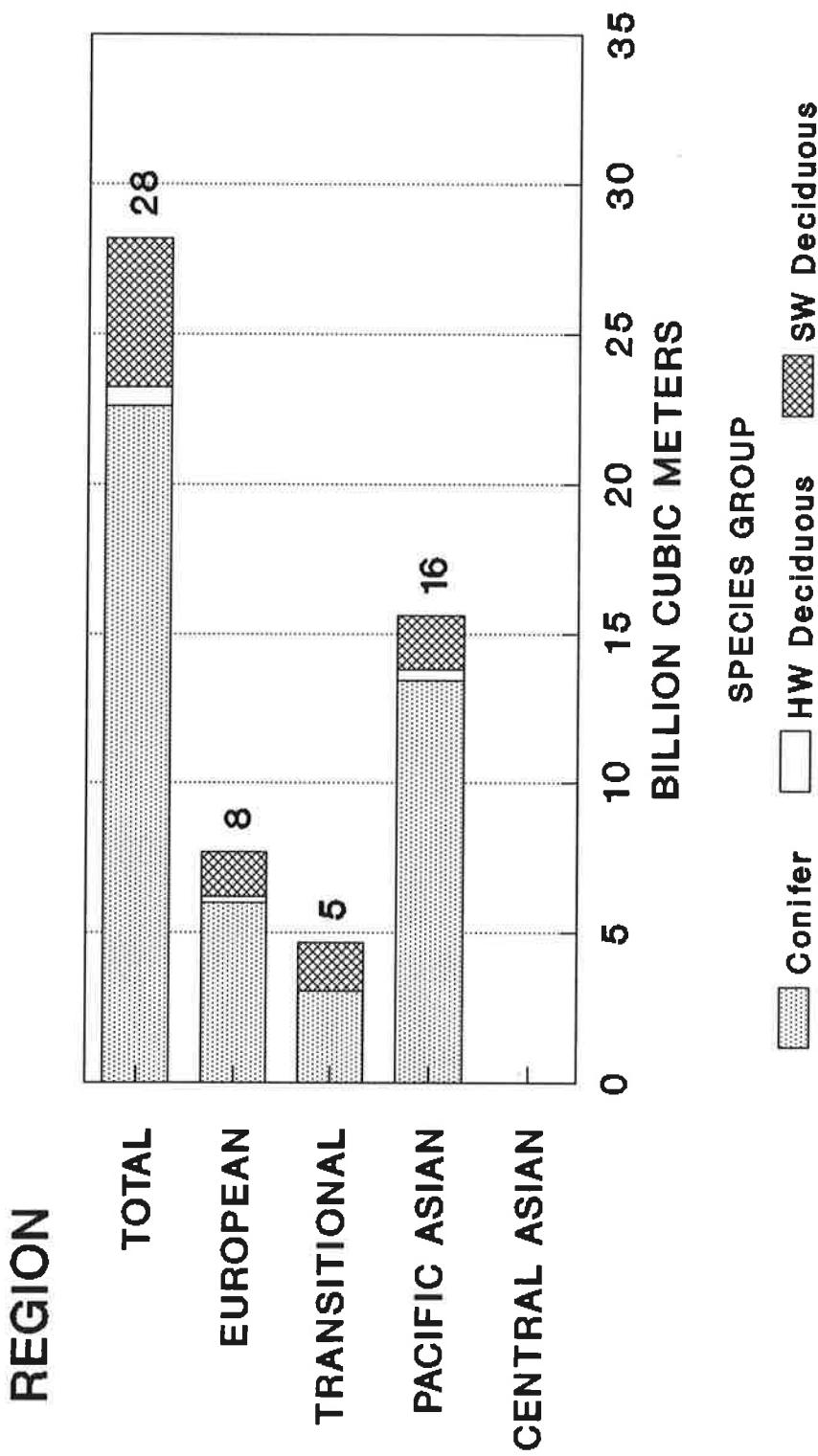
The large fall down associated with Group I forests (127 million hectares to 78 million hectares) is thought largely the result of the environmental protection role played by these forests. It is believed that some environmental restrictions effectively preclude harvesting of any type. It is primarily these forests which have been removed from the exploitable forest base. The same factors apply to the fall down of 4 million hectares in Group II forests. The decrease of 60 million hectares for Group III forests is largely accounted for by low site lands and stocked forest land supporting non-economic species not belonging to one of the three principal species groups.

The accessible and potentially accessible 406 million hectares of stocked forest land supports a sizeable volume of mature and over-mature wood (shown in **Figure 19**) estimated to be 28 billion cubic meters.⁵⁷ This is almost 60 percent of the total volume standing in mature and over-mature forests. Nearly 85 percent or 24 billion cubic meters is located in Group III forests. Group II forests contain 2 billion cubic meters while Group I forests contain slightly less than 2 billion cubic meters.

⁵⁶Lesnoye Khozaustvo, page 12

⁵⁷Detailed data about the distribution of mature and over-mature growing stock is shown in Table C25.

USSR ACCESSIBLE/POTENTIALLY ACCESSIBLE MATURE TIMBER (FOREST ADMINISTRATION) BY REGION AND SPECIES GROUP



CINTRAFOR/cab/trw

Figure 19

Coniferous species account for nearly 23 billion cubic meters or 80 percent of the accessible and potentially accessible growing stock. Hardwood deciduous species represent less than 5 percent. Softwood deciduous species account for nearly 5 billion cubic meters or 18 percent. Coniferous species account for the highest share in Group III forests and the lowest share Group II forests. The proportion accounted for by coniferous species in Group I forests is midway between that for Group II and Group III forests.

In addition to the forest resource under administration by the forest authorities, farm forests account for 48 million hectares of stocked forest land with 5.6 billion cubic meters of growing stock. Mature and over-mature share of forested land occupy 7 million hectares supporting growing stock of one billion cubic meters. The forest resource allocated to other non-agricultural and non forest agencies amounts to 17 million hectares of forested land and 2 billion cubic meters of wood. Five million hectares of forested land and 825 million cubic meters of growing stock are mature or over-mature.

All farm forests are considered accessible at this time. A large but undetermined portion of the resource allocated to other organizations is also believed to be accessible or potentially accessible, much greater than the 60 percent of mature growing stock under management by the forest authorities. At the present time, a preliminary estimate of 80 percent is considered feasible. This additional forest resource is believed to support an AAC of approximately 35 million cubic meters.

Thus, in addition to the forest resource administered by agents of the forest economy, another 62 million hectares of stocked forest land supporting 7 billion cubic meters of wood are available for timber harvest in the near to medium term. Almost 11 million hectares with one and a half billion cubic meters are mature or over-mature. Slightly more than half of the stocked forest land and nearly two-thirds of the growing stock in the mature and older age classes are coniferous species.

Total forested land and growing stock, then, available for exploitation is thus estimated to be 468 million hectares and 57 billion cubic meters. The AAC supported by this total forest resource is estimated to be between 660 million and 670 million cubic meters.

Allowable Annual Cut

The ability of the Soviet forest to support industrial development over time is measured by the allowable annual cut (AAC).⁵⁸ Forests under control of either *Goskomles* or directly by the timber industry amount to 931 million cubic meters.⁵⁹ Approximately 15 percent of this figure is credited to forest land area having site classes 5a and lower which do not have industrial significance. Thus, the allowable cut in forests which are currently and potentially accessible as well as reserve forests with site classes 5 and higher approaches 831 million cubic meters. The adjusted AAC would be about 861 million cubic meters if the allowable harvest from forests under control of other ministries and collective farms are included.⁶⁰ However, not all of this allowable cut is located in forests which are currently accessible or are expected to become accessible during the next 15 to 20 years.

Forests which are believed to be beyond the location of major transportation systems which are projected to be completed within the course of the next 15 to 20 years are classified as reserve forests. Reserve forests support an allowable annual cut of between 192 million and 201 million cubic meters.⁶¹ These forests are thought to be under the administration of the forest authorities. This volume is not expected to be realized, and hence is not realistically considered as relevant to potential harvest over the next two decades.

Thus, in the near to medium term, the realistic potential AAC is approximately 660 million to 670 million cubic meters. More than 94 percent of the total AAC is thought to come from forests under management of organizations of the forest economy. Four percent is attributed to forests under control of other ministries and organizations and only two percent from forests administered by the collective farms.⁶²

⁵⁸The AAC does not include intermediate utilization such as thinnings or wood derived through other utilization activities such as road construction. While an AAC is not available for these two types of utilization, in recent years, annually, intermediate utilization has yielded 45 million cubic meters and other utilization has yielded 20 million cubic meters. Together, this is equal to about 10 percent of the AAC from primary utilization. Primary utilization includes clearcutting and selective cutting from mature stands.

⁵⁹Lesnaya Entsiklopediya, Vol. 2, page 403

⁶⁰Lesnaya Entsiklopediya, Vol. 2, page 302

⁶¹Lesnaya Entsiklopediya, Vol. 2, page 302; Barr, B. and Braden, K., The Disappearing Russian Forest, page 56; Vorob'ev, G.I. et alia , Ekonomicheskaya Geografiya Lesnikh Resursov SSSR, page 58

⁶²Lesnaya Entsiklopediya, Vol. 2, page 302

Allowable Annual Cut from Forests Agency Forests

The AAC from forests (accessible and potentially accessible) under management by either *Goskomles* or directly by the timber industry, amounts to approximately 620 to 630 million cubic meters. This last AAC is supported by 406 million hectares of stocked forest land containing 50 billion cubic meters of growing stock.

Figure 20 delineates the allocation of the AAC corresponding to the forest resource under control of the forest authorities.⁶³ The total AAC is derived from Groups I, II, and III forests. Group I forests, which are oriented towards providing environmental, aesthetic, and recreation services, contributed 9 percent of the total AAC in 1989 or 59 million cubic meters from 78 million hectares of exploitable land. Group II forests, with primary industrial significance but requiring greater restriction of their use due to proximity to developed areas, contributed 107 million cubic meters or 17 percent of the total AAC from 53 million hectares of land. Group III forests , designated for industrial use, provided an AAC of 460 million cubic meters from 275 million hectares of land or 74 percent of the AAC from lands managed by either *Goskomles* or directly by the timber industry.

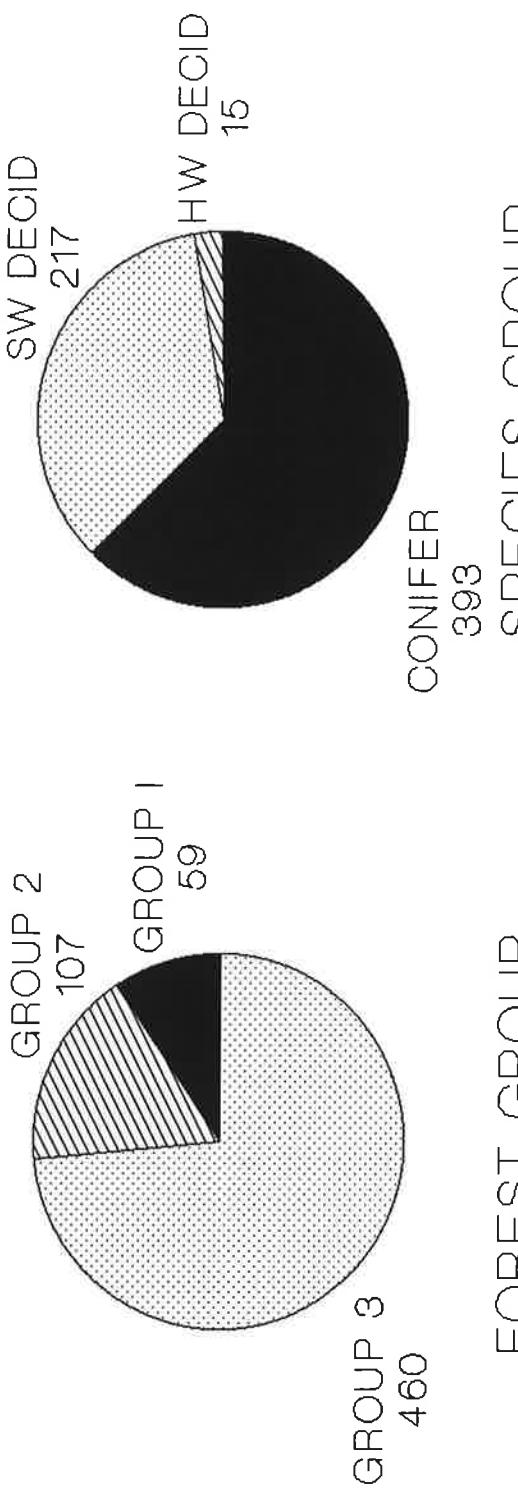
The allocation of the AAC into its species group components generally follows the pattern set by the distribution of species in the inventory. Coniferous species constitute 393 million cubic meters (or 63 percent), hardwood deciduous species contribute 15 million cubic meters (or 2 percent), while softwood deciduous species contribute 217 million cubic meters (or 35 percent). The lower coniferous component of the AAC (than in the forest inventory) is accounted for by the large proportions of coniferous volume contained in the reserve forests which do not contribute to the AAC at this time.⁶⁴

Given the distribution of species within each group of forest, it is not surprising that a greater share of the coniferous AAC is located in Group III forests. While supporting 73 percent of the AAC, Group III forests contribute 81 percent of the coniferous AAC, 40 percent of the hardwood Deciduous AAC, and 63 percent of the softwood AAC.

⁶³Table C21 details the allowable annual cut figures under control of the forest authorities.

⁶⁴Of the more than 200 million cubic meters of AAC in reserve forests, nearly 180 million cubic meters is located in coniferous species. Softwood deciduous species contain 22 million hectares and hardwood deciduous species contain one million cubic meters.

SOVIET UNION - ANNUAL ALLOWABLE CUT 1989 BY FOREST AND SPECIES GROUPS UNDER FOREST ADMINISTRATION



Total AAC = 625.3 Million CM

CINTRAFOR/cab/trw

Figure 20

Since 1980, the AAC has decreased by 13 million cubic meters from 638 million cubic meters to 625 million cubic meters. While the AAC was decreased in Group II and Group III forests by a combined total of 22 million cubic meters, the AAC in Group I forests actually increased almost 20 percent to 59 million cubic meters. Nearly all of the change occurred in the coniferous species component.

Future Outlook for the AAC

While overcutting in the past definitely contributed to the present decline in the AAC, future stability of the current AAC may be in jeopardy from completely separate factors. These factors include air pollution, insect and disease attacks, and forest fires.

Forest lands thought to be active breeding grounds for insects and disease have fluctuated between 2.7 million and 3.9 million hectares. The peak was reached in 1987 thereafter declining to almost 3 million hectares in 1989. The largest share of the forest land affected is due to insects which attack deciduous tree species followed by forest land which forms a breeding ground for insects posing a threat to coniferous species. The third most significant threat is forests which are breeding grounds for tree diseases. Most if not all of this forest land is thought to be on stocked forest land.⁶⁵

In addition to forest land which is threatened by pests and diseases, forest fire is a significant risk. In the last two years more than one million hectares of stocked forest land has been destroyed or damaged annually by fire. The area destroyed or damaged yearly by fire is almost half that which is clearcut.⁶⁶

While the effect of these factors is difficult to quantify, the cumulative impact on the long-term ability of forests in the European part of the USSR was recently examined.⁶⁷ The conclusion reached was that past logging practices in conjunction with poor forest management practices and industrial factors such as air pollution had contributed to an overstatement of the AAC by at least 10 percent or 27 million cubic meters.

⁶⁵Lesnoye Khozaustvo, page 88

⁶⁶Lesnoye Khozaustvo, page 92

⁶⁷IIASA Options, International Institute for Applied Systems Analysis, Sept. 1990, page 10

Regional outlooks are examined separately in the following sections. However, if the 10 percent overstatement is applied for the whole country, an AAC in the short to medium term of 570 million cubic meters seems likely for forests under the management of the forest authorities and approximately 600 million cubic meters for the country as a whole when including the forest resource managed by organizations other than those of the forest economy.

THE HARVEST

The forest industry of the Soviet Union has "officially" produced between 355 million and 390 million cubic meters of roundwood annually since 1960.⁶⁸ Excluded from these figures are thought to be approximately 40 million cubic meters of harvest from collective farms and about 40 million cubic meters from small harvesting operations which lie outside the control of the main participants of the forest economy.⁶⁹ Thus, the estimated harvest for all management responsibilities has varied from 435 million cubic meters to 470 million cubic meters, and from 395 million cubic meters to 430 million cubic meters if the estimated harvest from collective farm forests are excluded. The harvest from the forest resource managed by the forest authorities accounts for approximately 90 percent of the estimated total harvest.

The wood from lands managed by the forest authorities is produced under what is termed either principal utilization, intermediate utilization, or other utilization. Principal utilization is conducted largely in mature stands, primarily in Group III forests with some occurring in Group II forests. Intermediate utilization occurs in all groups of forests and includes stand improvement, thinning, and sanitation fellings. Other utilization is thought to occur in Groups I, II, and III forests mainly in response to industrial development.

Since 1960, the share of intermediate utilization has steadily increased from 6 percent to 12 percent of harvest from the principal utilization. The harvest from other utilization since 1980 has fluctuated and currently accounts for 6 percent of the

⁶⁸FAO Forest Products Yearbook, various years

⁶⁹Voyevoda, I.N. and Petrov, A. P., Territal'niye Otraslyeviye Kompleksiy, page 18

harvest under the principal utilization. **Figure 21** shows harvest from each of the three utilization practices and total harvest for selected years.⁷⁰

Utilization of the AAC

Wood volume produced under the principal utilization amounted to 332 million cubic meters in 1989, down from 345 million cubic meters in 1988.⁷¹ The main technique used is clearcutting which amounted to almost 95 percent of the area and volume harvested in 1989. Nearly 2 million hectares have been clearcut annually in recent years, which produced in 1989 a volume of 315 million cubic meters. An additional 17 million cubic meters was produced by selected harvesting techniques. Group I forests, while sustaining 9 percent of the AAC, provided 27 million cubic meters or 8 percent of the harvest in 1989. This represented only 45 percent of the AAC available in Group I forests. Group II forests, while supporting 17 percent of the AAC, provided 25 percent of the harvest, representing 76 percent of the Group II AAC in 1989. Group III forests, providing 74 percent of the AAC, yielded only 67 percent of the harvest which represented 49 percent of the available AAC in 1989.

Coniferous species are more heavily utilized than the deciduous species. In 1989, 60 percent of the AAC attributed to coniferous species was harvested versus nearly 50 percent for hardwood deciduous species and 40 percent for softwood deciduous species. Data for each group of forest indicating the harvest by component species groups is unavailable. It is believed however that in all cases, the coniferous component is more heavily utilized relative to the potential AAC.

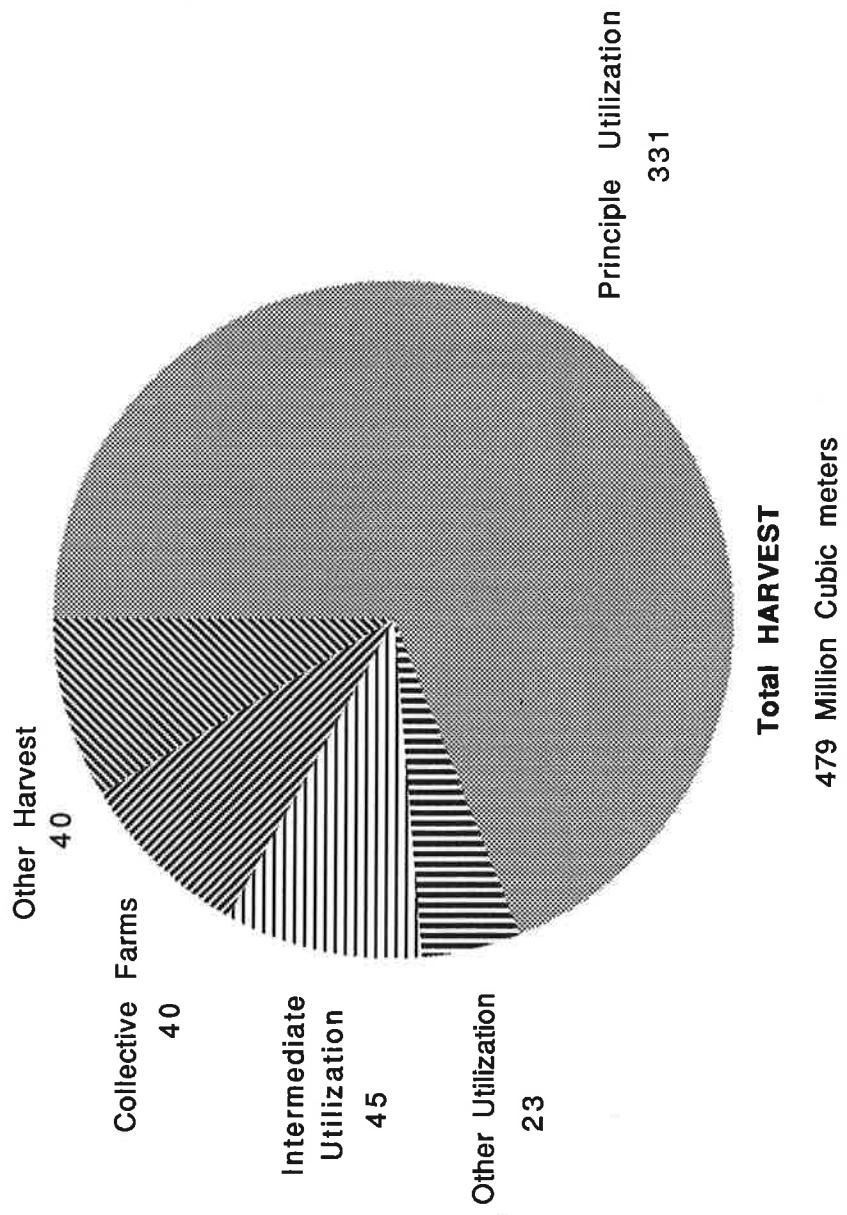
The estimated AAC in collective farm forests is 15 million cubic meters. This contrasts with the reported annual harvest of 40 million cubic meters. However, it is believed that a large portion of this harvest is derived from intermediate utilization. Thus, it would seem that the AAC from these forests is nearly fully utilized rather than being substantially exceeded.

Harvest figures from forest land not included in either the collective farm resource or forest authority resource are not available. However, assuming that the cut from

⁷⁰Table C22 shows in greater detail harvest between 1980 and 1989.

⁷¹The AAC and wood volume are for the forest resource under control of the forest authorities.

SOVIET ESTIMATED TOTAL TIMBER HARVEST 1989



small operators originates from this forest resource, then it would appear again that the AAC is being exceeded. The AAC is reported to be 30 million cubic meters. However, assuming that part of the harvest also is derived from intermediate utilization, it would appear that this AAC is also being fully utilized.

From this discussion, it follows that most of the unutilized AAC is under the administration of the forest authorities which is estimated to be 293 million cubic meters. **Figure 22** shows the relationship between AAC and harvest for selected years between 1980 and 1989.

Intermediate Utilization and Other Utilization

In addition to the wood harvested from mature and over-mature stands under principal utilization, the Soviet forest industry has realized 45 million cubic meters which come from thinning in immature forests and are included in intermediate utilization. Other utilization is connected with industrial development and has contributed more than 20 million cubic meters annually since 1986.⁷² Estimated thinning harvest from collective farm forests amounts to 15 million cubic meters and 10 million cubic meters annually from small harvesters. Both wood produced from intermediate utilization and other utilization lie outside the AAC, but is estimated to contribute more than 15 percent of the country's wood supply, which in 1989 amounted to nearly 480 million cubic meters if the harvest from collective farm forests and harvesting from small harvesting units not connected with the major participants of the forest economy are included.⁷³

REGENERATION

The forest industry of the Soviet Union delivers approximately 355 million cubic meters to 390 million cubic meters of logs annually using a number of different types of harvesting techniques.⁷⁴ The major technique has been to clear cut the standing

⁷²The harvest under the three different utilizations is derived from the forest resource administered by the forest authorities.

⁷³In 1989, harvest under the principal utilization amounted to 331 million cubic meters, harvest under the intermediate utilization amounted to 45 million cubic meters, and harvest under other utilization amounted to 22 million cubic meters. Thus the sum total of harvest from all utilizations was 398 million cubic meters. Adding the 40 million cubic meters of harvest from collective farm forests and 40 million cubic meters from the small harvesting units increases the estimated wood supply to 480 million cubic meters.

⁷⁴The delivered wood has been within the "planned system", and is considered the "official" harvest.

**SOVIET UNION - Unutilized AAC, Major Harvest, Intermediate Harvest,
and Other Harvest for Selected Years 1980 - 1989**

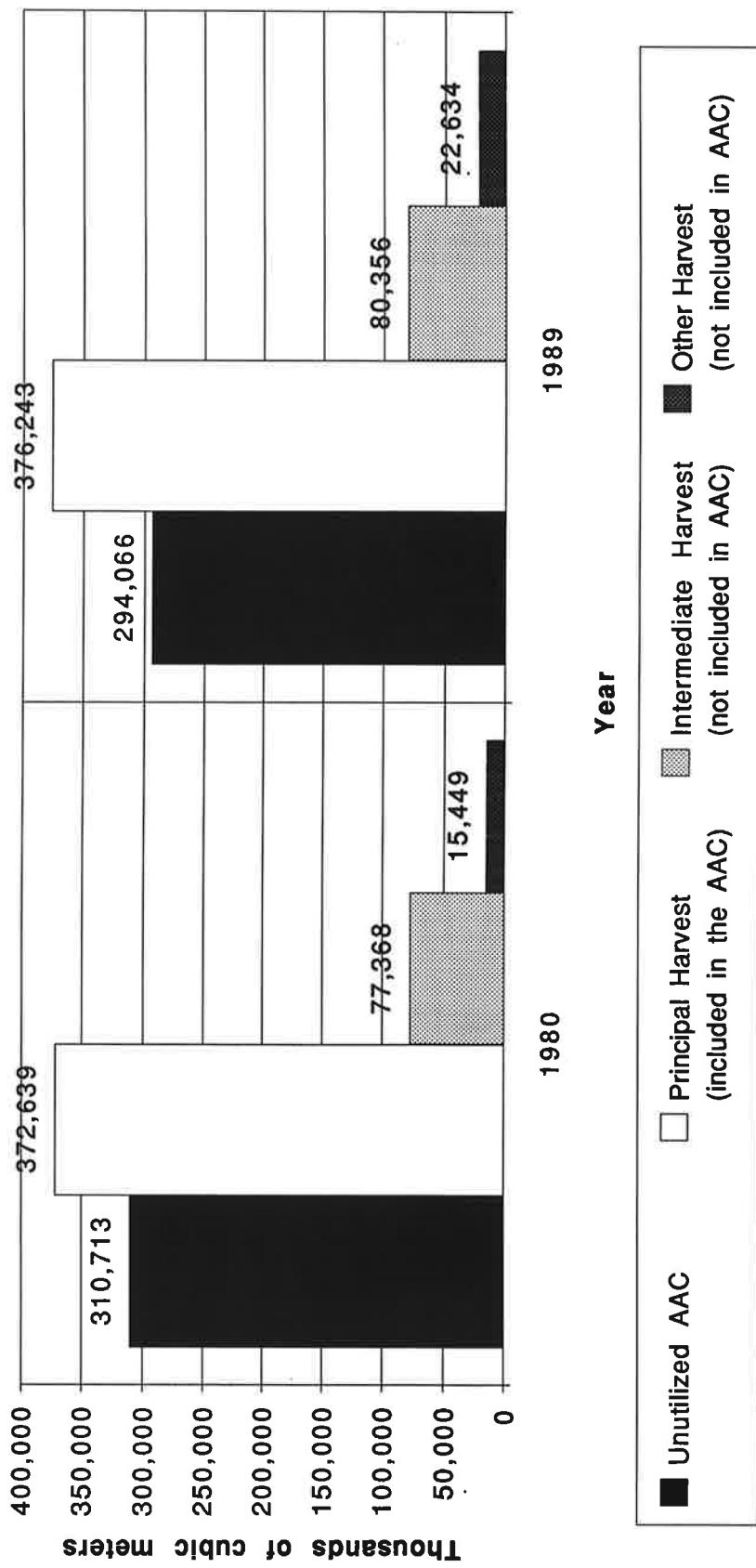


FIGURE 22

forest and then to restock the cleared land with a new crop of trees using either artificial or natural means. Sanctioned clear-cutting on land administered by the forest authorities has taken place on between 1.9 and 2.0 million hectares annual since 1980.⁷⁵ Actual area clearcut is believed to approach 2.5 million hectares.⁷⁶ While reported reforestation work has amounted to 2.2 million hectares annually between 1980 and 1989, it is believed that the difference is not a clear indication of area not receiving forest management attention. Thus, it is thought that reforestation work has continued at a pace similar to the rate of clearcutting.

Not considered, however, is the large area of stocked forest land which is subjected to forest fire. From 1985 to 1989, almost 5 million hectares were so affected. While the extent of damage is far from certain, it is believed that most of the growing stock would be killed or damaged and rendered largely unusable if not salvaged within three years of the fire. Sufficient resources have been unavailable to salvage and utilize the damaged trees. Thus, much of this burned land must be considered unstocked for an indeterminate period following fire. Data for burned areas by stand condition, age, or species is not available.

While current reforestation efforts appear to be keeping pace with clear cutting, more disturbing developments are evident in the rate at which previously reforested stands are passed into the youngest age categories of the forest fund. Between 1985 and 1989, the average area of forests which were admitted into the youngest age classes has never exceeded 1.7 million hectares. In 1989 in fact, there was a sharp drop to 1.4 million hectares, only slightly more than two thirds of the area which is reported clearcut annually in the Soviet Union. In addition, there has been a marked deterioration in the share of stands admitted to the forest fund which were initially restocked using artificial means. While in 1980 and 1985 plantations accounted for almost 50 percent of the new stands that were considered stocked, by 1989 this share had decreased to 33 percent or only 468 thousand hectares. Assuming a 20 year period between the time a stand was established and reaching the lowest age

⁷⁵While other utilization is effectively clearcutting, the intended use of the land is other than to grow trees. While amounting to 640 thousand hectares in 1989, it should not be considered as land which should be restocked and thus reflect negatively on the forest management performance of the Soviet forest establishment.

⁷⁶Stadnitskiy, G. V., and Ignatov, A. F., *Lesnoy Kompleks: Nastoyashchye i Budushchye*, Lesnoy Zhurnal, No. 9, 1989, page 115.

class for the forest fund, only about 36 percent of the stands originally restocked using artificial means have been successful.⁷⁷

While the above discussion would suggest that the forest wealth of the Soviet Union is being reduced, estimates of the stocked forest land from successive forest inventories shows a constant increase. From 1953 until 1988, forest land has increased continuously from 815 million hectares to 942 million hectares.⁷⁸ Stocked forest land has increased from 697 million hectares to 814 million hectares.⁷⁹ Thus, even though the national statistics suggest an expanding forest resource, the underlying quality of that resource may in fact be decreasing.

THE PROJECTED DEMAND

As Backman and Waggener show, the potential pent up demand in the USSR is enormous.⁸⁰ For the USSR to approach the per capita consumption of West Germany in 1989, let alone the United States, would require additional import/production of 15 million metric tons of pulp. This is the equivalent of 140 percent increase in existing capacity; and represents an impressive 60 percent of the 1989 world exports of wood pulp. For paper and paperboard, this would require more than 45 million metric tons of new capacity. This represents more than a 400 percent increase over the current production level; and nearly 100 percent of the 1989 world paper and paper board trade. For wood based panels, an increase in capacity or imports of nearly 30 million cubic meters is required. This is nearly 200 percent above the current capabilities; and would represent nearly 100 percent of current world export volume.

The additional fibre requirements represented by these potential consumption volumes is 255 million cubic meters.⁸¹ The additional requirement is less than the 293 million cubic meters of the currently unutilized AAC.

⁷⁷In 1970, according to Barr and Braden in "The Disappearing Russian Forest", 2,354 thousand hectares were restocked of which 1,290 thousand hectares were by artificial means. Thus, 468 thousand hectares divided by 1,290 thousand hectares equals 36 percent success rate.

⁷⁸The effective date of the most recent inventory is 1988. The Soviet Union has taken account of the inventory in the forest fund 8 times since the early 1950's - 1953, 1956, 1961, 1966, 1973, 1978, 1983, and 1988.

⁷⁹Lesnoye Khozaustvo, page 4

⁸⁰Backman, Charles A. and Waggener, Thomas R., Soviet Forests at the Crossroads, CINTRAFOR Working Paper # 28, 1990, pages 357 to 362.

⁸¹Assume that each ton of pulp requires 5 cubic meters of wood fibre and for purposes of calculation, there is a shortage of 15 million tons. The 15 million tons of pulp can be turned into

Recent Soviet literature estimates that in the near to medium term, an additional 100 million cubic meters of fibre are needed.⁸² While the higher demand is expected to be satisfied by an increase in use of by-products such as chips and recycling of paper products, overall harvest is projected to rise between 30 million and 40 million cubic meters as well.⁸³

It is unlikely that Soviet exports will be voluntarily decreased in the near term in order to meet the projected increase in internal demand due to the need to generate hard currency.⁸⁴ Thus any increase in consumption must come from either imports (unlikely given the shortage of hard currency) or from increased domestic production.

The ability of the industry in the USSR to meet the demands placed on it can best be answered by examining the inventory and harvest on a regional basis.

THE REGIONS

Statistics which describe the forest inventory, harvesting, and consumption on a national level mask a wide regional variation that effectively divides the country into four separate regions. These regions are: (1) The European USSR; (2) Central Asia; (3) Transition RSFSR or Western Siberia; and (4) Pacific Asian USSR or East Siberia and The Far East. While the Soviet forestry establishment has traditionally divided the country into two distinct regions: European USSR and Asian USSR including Central Asia, a careful examination of the available information, however, suggests there are four regions.⁸⁵

15 million tons of paper. Thus, the actual shortage is only 30 million tons of paper. Therefore, the wood fibre needed consists of 75 million cubic meters for pulp, 150 million cubic meters for paper, and 30 million cubic meters for board products. The total is therefore 255 million cubic meters.

⁸²Petrov, A.P., *Ekonomicheskiye Priorityeti Ispol'zovaniya Lesnov i Grupi, Lesnaya Promishlenost'*, January 1991, page 22

⁸³Outlook for the Forest and Forest Products Sector of the USSR, United Nations ECE/TIM/48, pages 42, 54

⁸⁴From 1985 and 1989, between 15 million and 20 million cubic meters of roundwood and between 7.7 million and 8.2 million cubic meters of lumber were annually exported (net of imports). These two product categories account for the majority of the net export of wood fibre from the Soviet Union.

⁸⁵Soviet forests are also divided according to the degree that stocked forest land occupies the total land area in any particular region. The forests are thusly divided into "much forested" and "little forested" regions. For the most part, "much forested" regions are located in the northern and north-eastern part of the European USSR, the Transitional RSFSR and the Pacific

The traditionally defined Asian Region can be divided into an Asian Pacific region (encompassing most of the mountain forest resource) and a Transition RSFSR (or Western Siberia) which lies immediately adjacent to the European part of the country and contains little mountain forests. There is a significantly greater degree of development there than in Pacific Asia (or the Far East or East Siberia) due in part to the close proximity to the developed part of the country and the less inhospitable terrain and climate.⁸⁶ The orientation of Pacific Asia is towards the markets of the Pacific Basin while Transition RSFSR is oriented more towards Europe and European USSR. In addition, the traditional Asian USSR includes a Central Asian region which incorporates most of the sparsely stocked and desert areas of the USSR. This region has been and is expected to be a net importer of forest products and thus forms one of the market areas to which the output of the Soviet forest sector can be directed. **Figure 23** shows the major economic regions of the USSR.

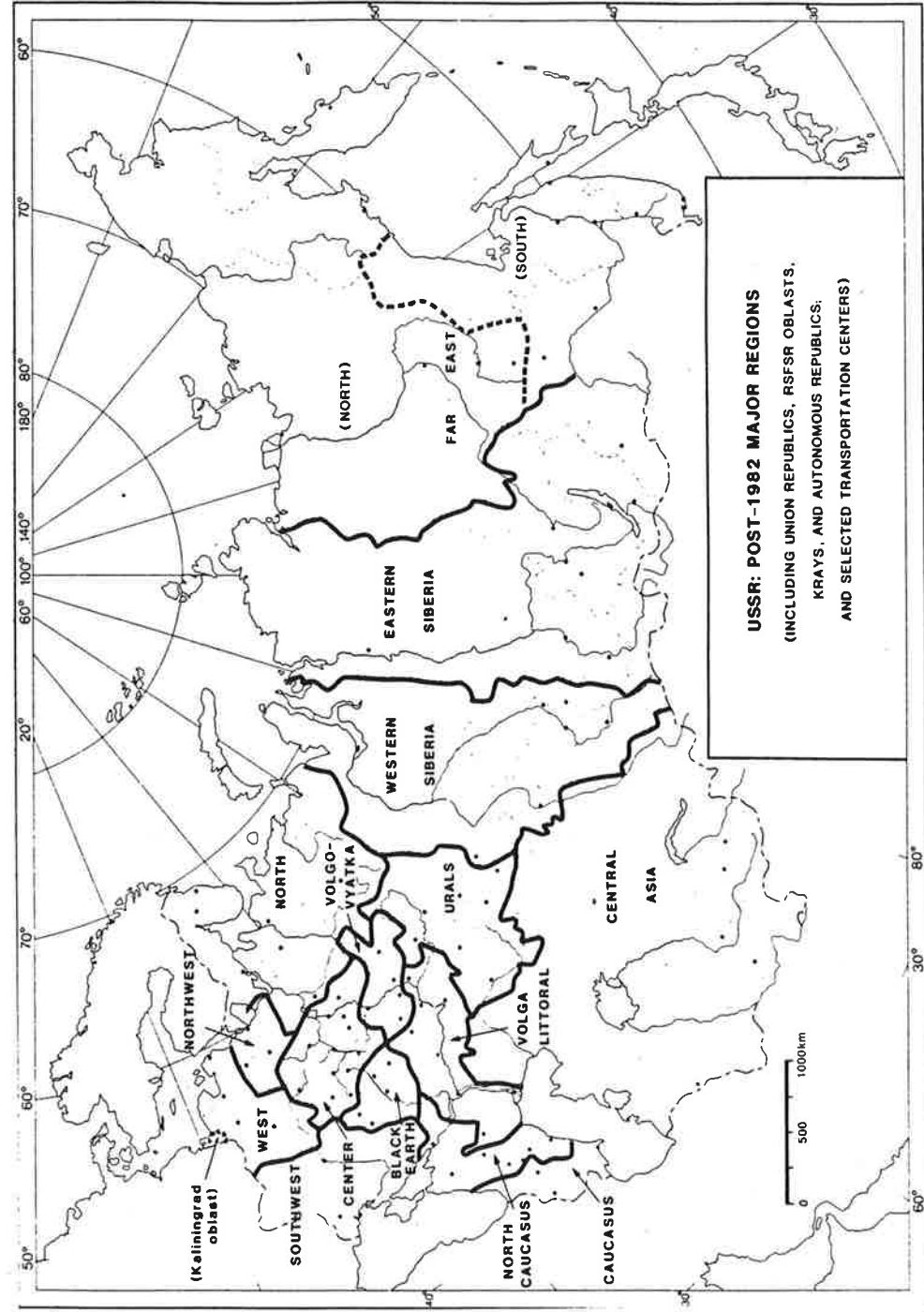
Table C26 shows the distribution of the forest resource, industrial activity and population based on the four regions. Tables C27 and C28 provide a more detailed examination of the forest resource. The European region contains the majority of the population and forest industrial activity accounting for 74 percent of the population, 61 percent of the harvest, 63 percent of the lumber production, 84 percent of the plywood production, and 84 percent of the paper and paperboard production. However, only 22 percent of the stocked forest land and 23 percent of the growing stock is located in the European region. Pacific Asian USSR, on the other hand, contains the majority of the forest resource but is underdeveloped in terms of industrial activity. Pacific Asia accounts for 65 percent of the stocked forest land and 64 percent of the growing stock but includes only 6 percent of the people, 29 percent of the harvest, 25 percent of the lumber production, 12 percent of the plywood production, and eleven percent of the paper and paperboard production. The Transition RSFSR region is

Asian region. "Little forested" regions are located in the middle and southern part of the European USSR and in Central Asia.

The regional definitions utilized in this paper reflect the interaction between the location of major industrial processing centres and domestic population, and markets relative to the forest resource.

⁸⁶The permafrost region underlays most of the land area encompassed by the Pacific Asian region, lying for the most part east of the Yenisey River which marks the approximate boundary between East Siberia, one of the two economic regions making up the Pacific Region, and West Siberia or Transition RSFSR. The location of the permafrost zone has been delineated in **Figure 5**.

THE MAJOR ECONOMIC REGIONS OF THE SOVIET UNION



Source: The Disappearing Russian Forest, page 12

Figure 23

located between these two major regions of the Soviet Union, and thus has a more balanced pattern. While containing 11 percent of the stocked forest land and 13 percent of the growing stock, it accounts for 5 percent of the people, 9 percent of the harvest, 9 percent of the lumber production, 3 percent of the plywood production, and one percent of the paper and paperboard production. Central Asia is a minor contributor to the forest industry of the Soviet Union.

Thus, four roles can hypothesize for the four regions. European USSR, while being the main purveyor of manufactured forest products, must in part rely on the raw material from the more bountiful regions located to the east in the Asian part of the country. The two regions making up the forest surplus areas of Asian USSR are the Transition RSFSR and Pacific Asian USSR. These two regions in turn must supply not only their own regional domestic consumption, but must also provide unprocessed roundwood to both Central Asia and European USSR.

In addition to supplying the needs of the domestic industry, the non Central Asia regions must also seek to meet export commitments which in the past five years have mounted to between 15 million and 20 million cubic meters, or almost 15 percent of the "official" commercial harvest of the nearly 300 million cubic meters.⁸⁷ Approximately half of the log exports have been destined for Asian markets of China and Japan. The remaining half has been exported to East and West Europe. It is believed that exports to Asian markets originate no further west than Pacific Asia while exports to Europe originate no further east than Transitional RSFSR.⁸⁸ Thus, the forest industry in Pacific Asia must in addition to domestic and other internal demands to the USSR, also meet the export requirements of the Pacific Basin. Correspondingly, the western forest industry, primarily in the European USSR, must also consider the market needs in Europe.

⁸⁷The harvest volumes discussed above include a portion attributed to firewood which in recent years has been approximately 22 percent of the total harvest. Thus, in 1988 for example, wood deliveries amounted to 386 million cubic meters. Of this amount, industrial wood amounted to 305 million cubic meters while firewood amounted to 81 million cubic meters.

⁸⁸Lesnoy Eksport SSSR, page 122

THE EUROPEAN USSR

THE FOREST RESOURCE

Overview

The European part of the country, consisting of those republics and sub regions of the Russian republic west of the Ural Mountains and Caspian Sea , account for 19 percent of the total land area and 21 percent of the forest land, but nearly 25 percent of the stocked forest land (all land categories are included in the forest fund).^{89, 90} However, while containing one quarter of the stocked forest land, European USSR includes only 17 percent of the mature and over-mature stand area. Almost 24 billion cubic meters of forest inventory volume or 28 percent of the national total are included in this region. Of this volume, 10 billion of which is classified as mature and over-mature. Only 32 percent of the stocked forested land and 40 percent of the volume is classified as mature and over-mature. While containing 20 percent of the nation's mature and over mature forests, the European region accounts for over 25 percent of the accessible and potentially accessible mature and over-mature volume. The average stocking per hectare, regardless of accessibility, is 152 cubic meters in mature and over-mature stands and 105 cubic meters in immature stands. Tables C27 and C28 provide a regional breakdown of the forest resources of the USSR.

Administrative Responsibilities

As shown in **Figures 24 and 25**, the European region contains 192 million hectares of stocked forest land and 24 billion cubic meters of growing stock.⁹¹ Only 80 percent of the area and volume (excluding that allocated to long-term uses) is under the jurisdiction of the forestry administration reflecting the more diverse use patterns

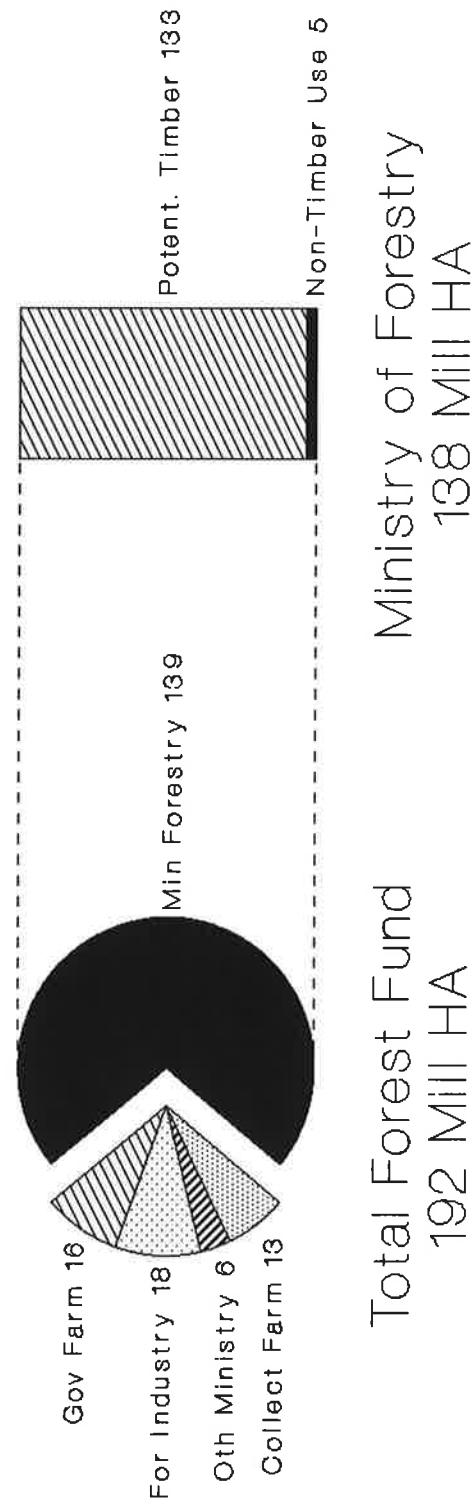
⁸⁹The republics included in the European part of the USSR include Latvia, Lithuania, and Estonia, Belorussia, Moldavia, and the Ukraine, as well as the Transcaucas Republics of the USSR which include Azerbaijan, Armenia, and Georgia. The sub-regions of the Russian republic incorporated into the European Region include the North, Northwest, and Ural regions as well as the Centre, Volga Littoral, Volga Vyatka, Black Earth, and North Caucasus. The European sub-regions of the Russian republic account for 21 percent of the stocked forest land and 24 percent of the standing volume of the whole republic.

⁹⁰The shares of the forest resource in European USSR belonging to European Russia are: 87 percent of land; 86 percent of forest land; 86 percent of stocked forest land; 97 percent of the mature and over-mature stocked forest land; 83 percent of the growing stock; 95 percent of the mature and over-mature growing stock.

⁹¹Tables C35 and C36 present detailed figures concerning the distribution of the forest resource among the different administrative responsibilities.

EUROPEAN USSR FOREST LANDS BY MAJOR MANAGEMENT ORGANIZATION

Million Hectares

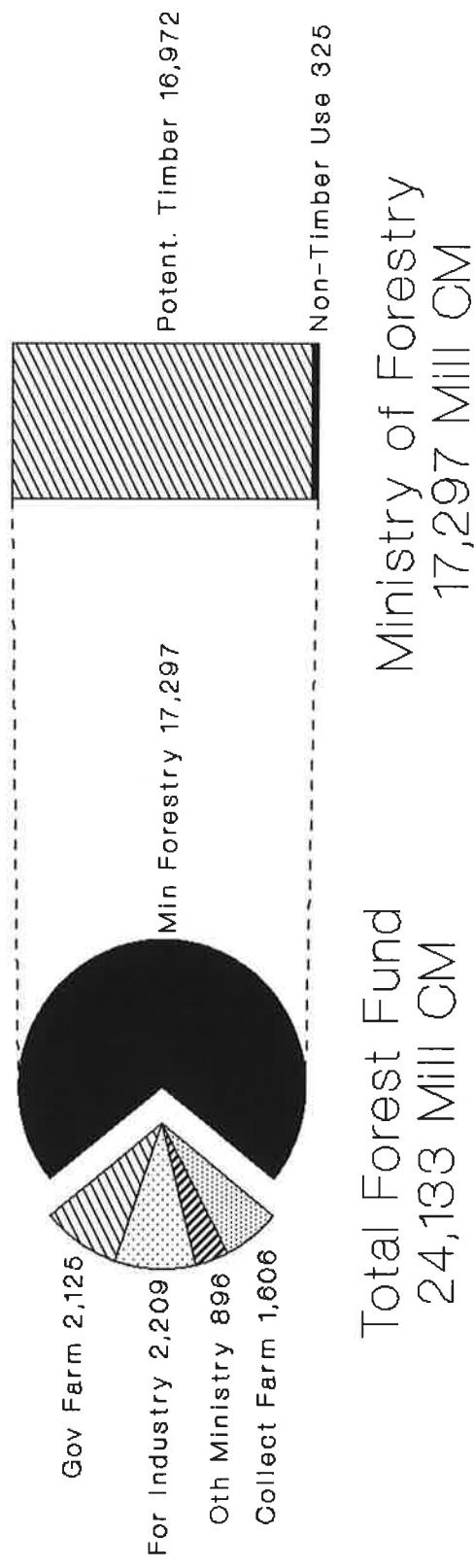


CINTRAFOR/cab/trw

Figure 24

EUROPEAN USSR FOREST INVENTORY BY MAJOR MANAGEMENT ORGANIZATION

Million Cubic Meters



CINTRAFOR/cab/trw

Figure 25

present in the developed part of the country.⁹² Collective farms and government farms contain 15 percent of the volume and area. The rest of the forest is either allocated for long-term use and administered by the forest authorities or is administered by other non-agricultural ministries. While forests allocated to other non-agricultural ministries support sufficient stocking to have industrial potential - 173 cubic meters per hectare in the mature and over-mature age classes and 127 cubic meters per hectare in the immature age classes, the forests for long-term uses do not - 66 cubic meters and 64 cubic meters respectively.

Farm forests, including collective farms and government farms (government farm forests are located in land allocated to other ministries), are primarily situated in the European part of the country. While representing only 5 percent of the forest land and 6 percent of the stocked forest land at a nationally, these two ownerships account for more than 15 percent of both the stocked forest land and total growing stock of European USSR. Farm forests, in which only 12 percent of the stocked forest land and 17 percent of the volume are mature and over mature, are generally younger than other ownership categories in European USSR. In forests managed by organizations of the forest economy for long-term uses (where most of the remaining resource is located), 35 percent of the stocked forest land and 44 percent of the growing stock is mature and over-mature. Farm forests support higher volumes per hectare in mature and over-mature stands of 192 cubic meters versus 159 cubic meters and immature stands of 119 cubic meters and 109 cubic meters. In all probability, the higher figures are connected to a greater concentration of better sites and more complete stocking believed to be located in farm forests.

In farm forests, the major species group, softwood deciduous species, occupy 50 percent of the stocked forest land. Hardwood deciduous species account for 8 percent while coniferous species occupy 42 percent. Forests administered by the forest authorities, in comparison, consist mainly of coniferous species (nearly 60 percent) while hardwood deciduous species account for 7 percent. Nearly 30 percent of the total stocked area is occupied by softwood deciduous species. Farm forests are connected with organizations whose primary responsibilities are the production of agricultural goods and services. As such, these forests are generally located adjacent

⁹² By comparison, in the Pacific Asian region of the country, more than 90 percent of the stocked forest land and volume is under control of the forest authorities.

to or form part of the mosaic of land suitable for agriculture. This land appears better suited for deciduous species.

Land Under Control of The Forest Authorities

Slightly over 150 million hectares of stocked forest land supporting 19 billion cubic meters of growing stock are managed by the forest authorities.⁹³ Timber industry forests account for 10 percent of the forest resource while non-timber interests account for the remaining 70 percent, accounting for the 80 percent of the forest resource of European USSR managed by the forest authorities. Nearly 50 million hectares and 8 billion cubic meters are considered mature and over-mature.

The forest resource managed directly by the timber industry supports higher stocking in the mature age classes and a lower stocking in the immature age classes than *Goskomles* managed forests - 179 cubic meters per hectare and 97 cubic meters per hectare versus 157 cubic meters per hectare and 111 cubic meters per hectare. The growing stock per hectare in the mature and over-mature forests exceeds the minimum levels of 140 cubic meters per hectare considered by Soviets to be the minimum to support economical harvesting operations.

The Primary Use For Forests - The Forest Groups

As shown in **Figure 26**, of the nearly 160 million hectares of forest land, stocked forest land occupies 151 million hectares or 95 percent.⁹⁴ Only 3 percent or more than 4 million hectares are considered unstocked. Immature plantations which are not old enough to be considered stocked amount to more than 3 million hectares or 2 percent of the forest land. Nearly 60 percent of the stocked forest land is located in Group I and Group II forests. Of the remaining 64 million hectares in Group III forests, only 530 thousand hectares are classified as being reserve and special zoned forests. While Group III forests account for 42 percent of the stocked forest land, it contains almost 55 percent of the unstocked forest land of 4.3 million hectares.

⁹³The forests allocated to long-term use are under the administration of organizations of *Goskomles*, but have no industrial significance. These forests are excluded from the following discussion about the forest resource of the European USSR, re-emerging only for the sections dealing with site and stocking class.

⁹⁴Table C37 presents detailed information about the distribution of forest land among the different categories of forest land.

EUROPEAN USSR FOREST LAND UNDER FOREST ADMINISTRATION BY STOCKING

Ministry of Forestry and Forest Industry

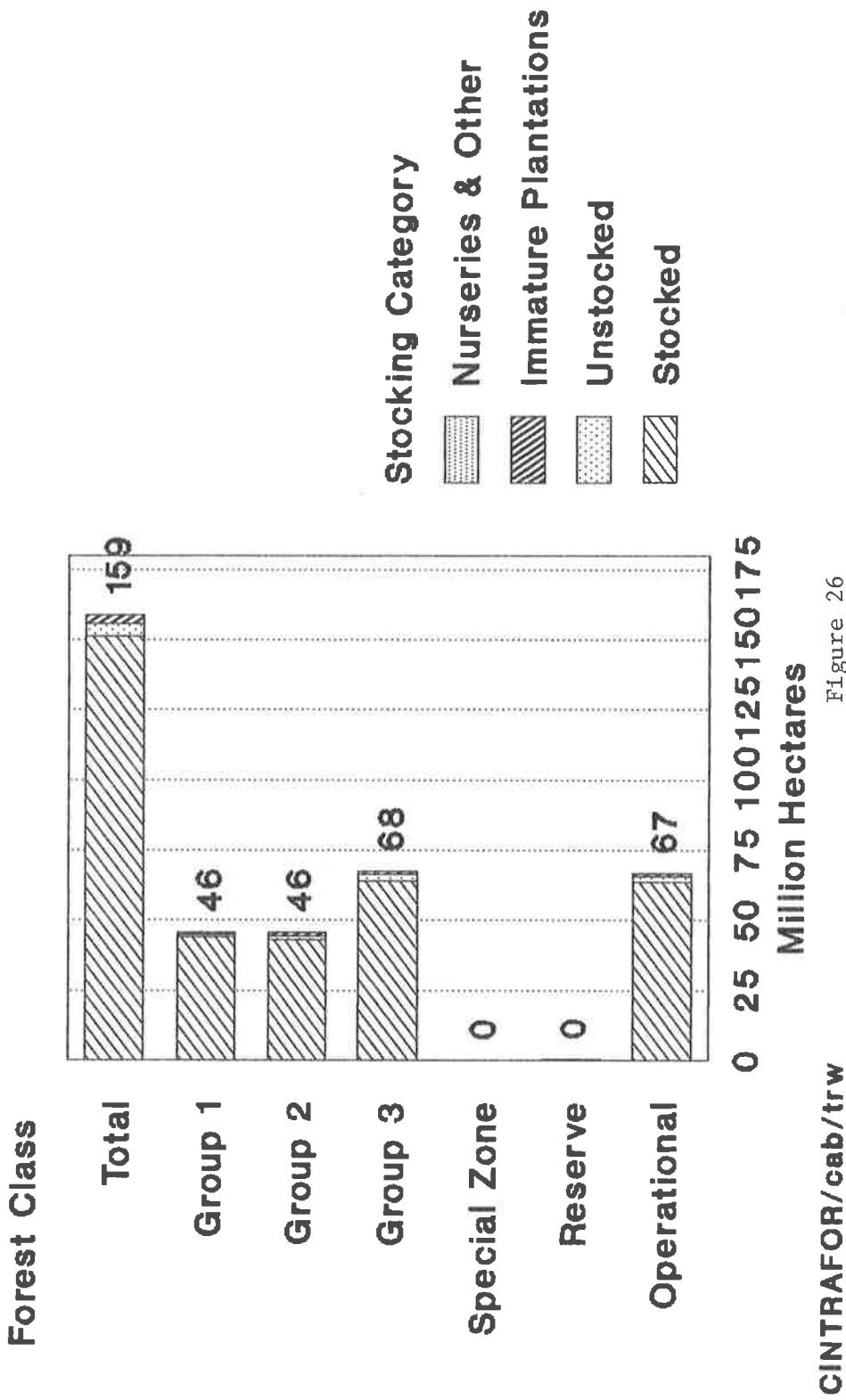


Figure 26

As shown in **Figure 27**, almost 80 percent of the unstocked forest land is land harvested and not yet re-stocked.⁹⁵ Minor amounts are located in small openings and glades, and burned forest land not yet supporting another crop of trees occupying each 5 percent of the forest land. The remaining 12 percent is accounted for by large openings and wasteland. More than 90 percent of this is located in Group II and Group III forests. Unstocked forest land in Group I forests contain significant forest land that is unstocked because of open or waste land, or glades and small openings. These types of lands amount to 60 percent of the unstocked forest land in Group I. Forest land unstocked following harvesting accounts for nearly all of the remainder within this group.

European USSR has the most developed infrastructure of all of the regions and thus would be expected to have the most intensively managed forests. The size of forest remaining unstocked provides an indication of the relative intensity of management. The share of the total forest land in European USSR which is unstocked is approximately 3 percent. This contrasts to 6 percent in the Transition RSFSR region, 15 percent in Pacific Asia and 34 percent in Central Asian region.

The industrial orientation of Groups II and III forests is reflected in the high share of unstocked forest land as a result of the harvesting activity. While Group I forests do contain unstocked forest land stemming from harvesting, most is accounted for by pastoral openings of various sizes in the stand. With the role oriented towards environmental protection, Group I forests should incorporate stands located on soils prone for movement and those including rock outcrops. Thus, it is not surprising to see the larger share of unstocked forest land accounted for by natural openings.

Species

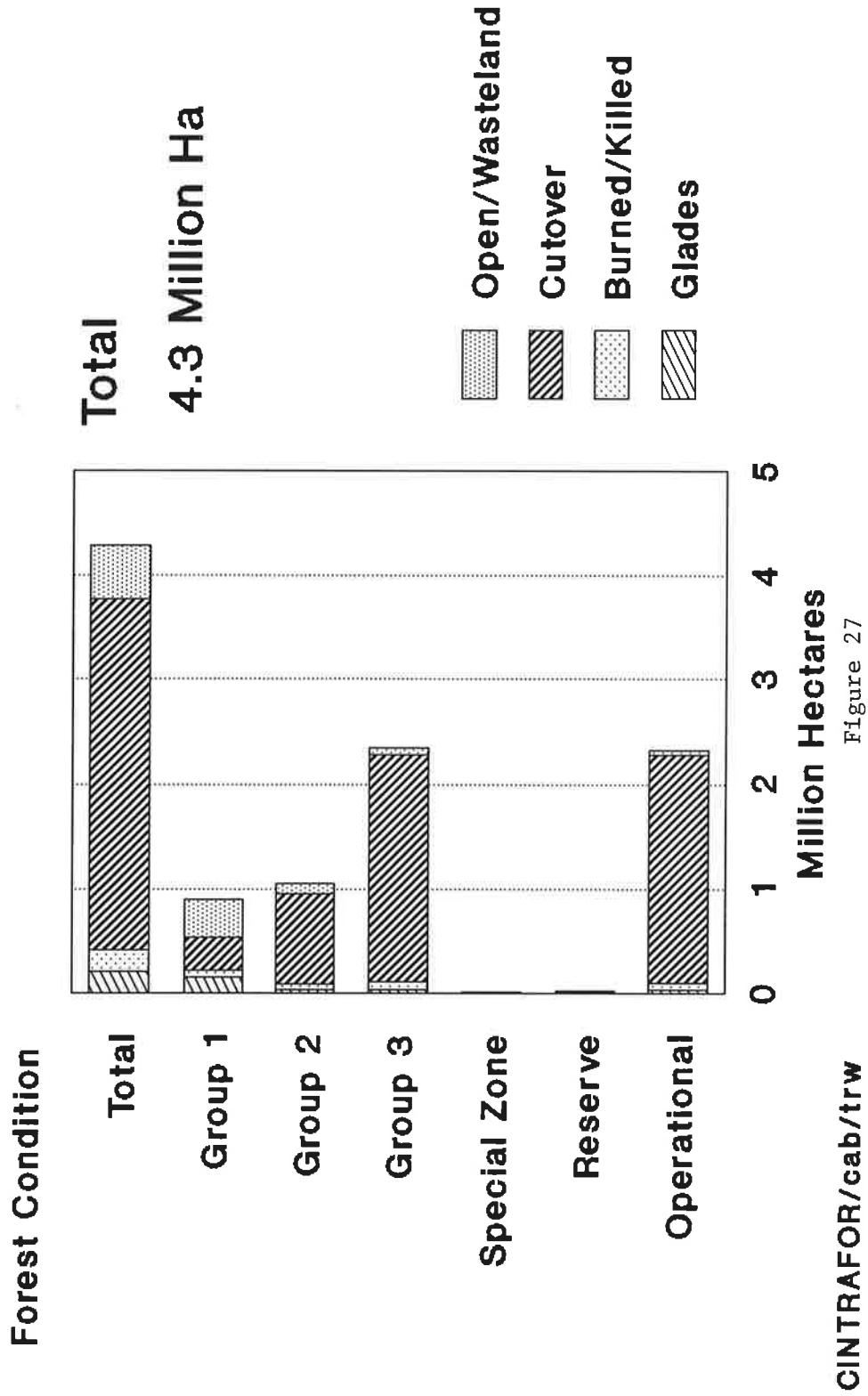
Information about the distribution of growing stock segregated by Group of forest is not available.⁹⁶ Rather detailed information is available on an area and volume basis

⁹⁵Table C38 shows detailed information about the distribution of unstocked forest land.

⁹⁶The land base which is described in this section excludes the forest resource allocated to non-timber long-term uses but includes the forest resource not accounted for by the three principal species groups.

EUROPEAN USSR UNSTOCKED FOREST UNDER FOREST ADMINISTRATION BY CONDITION

Ministry of Forestry and Forest Industry



for all groups of forest land combined as shown in Tables C39 and C40.⁹⁷

While the European region accounts for 20 percent of the stocked forest land and 28 percent of the growing stock of the USSR, nearly 40 percent of the region's stocked forest land and 35 percent of the growing stock are deciduous species (**Figures 10 and 11**). Hardwood and softwood deciduous species are more prevalent in the European part of the country (than in the other regions) accounting for 37 percent and 43 percent respectively of the total stocked forest land and 62 percent and 43 percent of the total inventory volume in these two species groups nationally. The dominance of deciduous species is consistent with the location of the two vegetation zones (Mixed Forested Zone and the Deciduous Forested Zone) in which climatic conditions favour deciduous species. The largest share of these two zones is located in the European USSR.

The major coniferous species growing in the European USSR region are pine and spruce, occupying 32 percent and 30 percent of the forested land. These two species constitute nearly 100 percent of the coniferous species. Pine and spruce account for 30 percent and 32 percent of the standing volume. Together, these two species account for nearly 100 percent of the standing coniferous volume. The major softwood deciduous species are birch and aspen which account for 21 percent and 5 percent of the stocked forest land (nearly 90 percent to the softwood deciduous total) and 18 percent and 6 percent of the standing volume (more than 85 percent of the softwood deciduous total). The major hardwood deciduous species are oak and beech which account for 4 percent and 2 percent of the stocked forest land (more than 80 percent of the hardwood deciduous total) and 4 percent and 2 percent of the standing volume (almost 90 percent of the hardwood deciduous total).

Site Class

The forests of the European region contain 23 percent of the USSR stocked forest land of 685 million hectares.⁹⁸ More than 65 percent of land classified as site class 2 and

⁹⁷Inventory information for farm forests segregated by species is not available. However, it is believed that the share within each species group accounted for by their respective principal species is not significantly different than the figures presented above.

⁹⁸Site class information is restricted to 156 million hectares containing the principal species located on the combined stocked forest land contained on Groups I, II, and III forests plus those forests allocated for long-term uses other than the production of timber. These forests are administered by either *Goskomles* or directly by the timber industry.

higher is located in the European USSR. Figure 28 shows that almost one third of the European region's stocked forest land is accounted for by the highest site class category.⁹⁹ Correspondingly, slightly more than 10 percent of the land base is in site classes below 5 which have limited industrial significance. Forests allocated for non-timber long-term uses in the European USSR region amount to 5 million hectares most of which are thought to be in site class 5a and lower. Thus the area containing forests with industrial potential amounts to almost 90 percent of the stocked forested land or nearly 140 million hectares.^{100, 101}

Softwood deciduous species occupy almost 44 percent of the land area in the highest site classes with coniferous species accounting for 47 percent and hardwood deciduous species accounting for 9 percent. This contrasts with Pacific Asia where more than 60 percent of the high site lands support coniferous species and softwood deciduous species represent nearly 40 percent.¹⁰²

Site class information is not available for the individual species for either the whole country or for the regional parts.

Stocking Class

A disproportionate share of the fully stocked stands are located in the European part of the country.¹⁰³ This region accounts for 38 percent of the 103 million hectares of

⁹⁹Table C41 provides a detailed presentation of site class data for the European USSR.

¹⁰⁰Site classes greater than or equal to 5. Excludes all site classes 5a and below

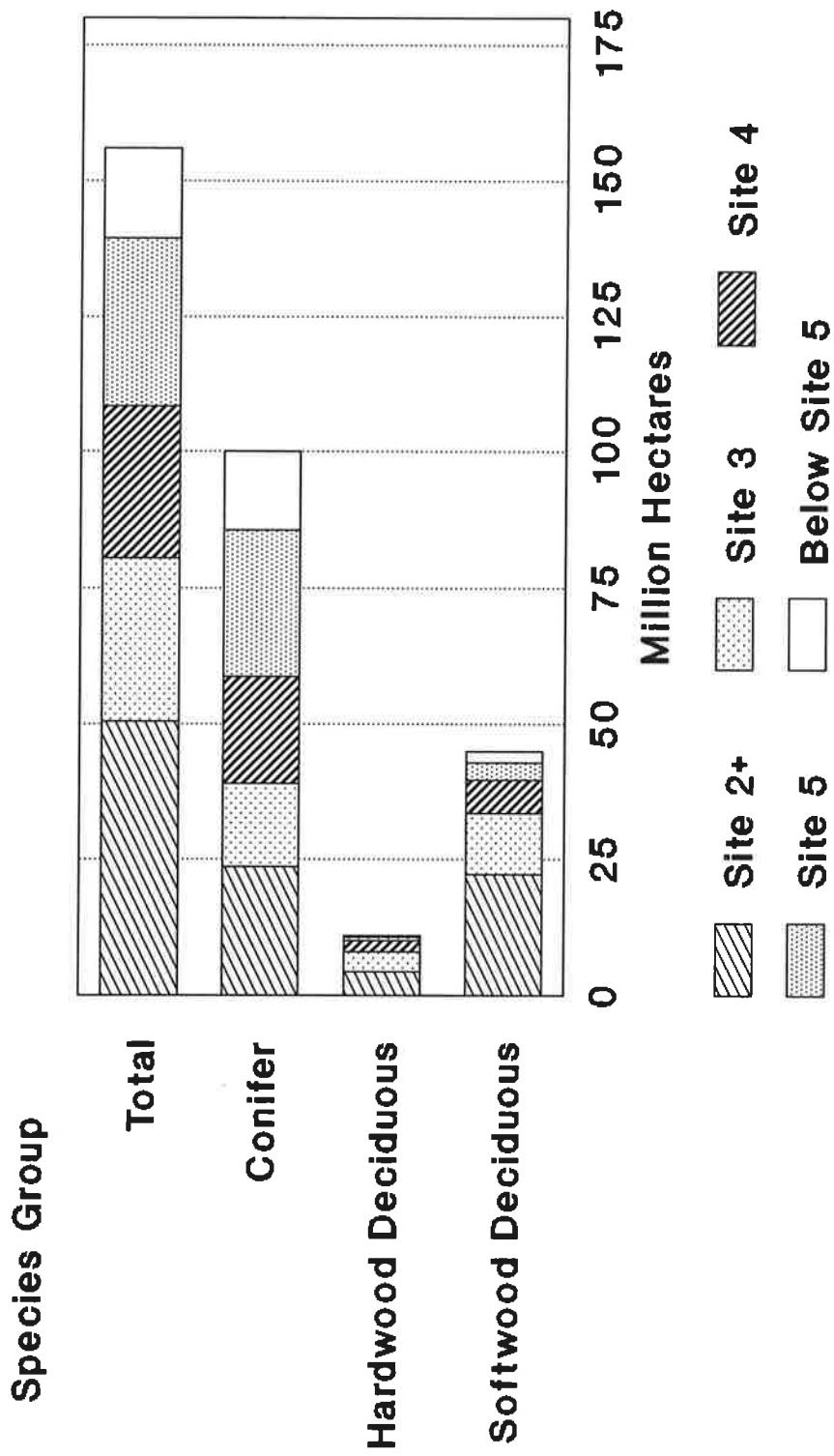
¹⁰¹While site class information is unavailable for either collective or government farms, it is believed that an even higher share of the forest land falls into the higher site and stocking classes. If these forests are added, more than 170 million hectares of forests have potential to support timber harvest. Adding the stocked forest land administered by other ministries and organizations not belonging to either the agricultural or forest sectors would increase the pool to almost 175 million hectares.

¹⁰²The contrast with Pacific Asia is not surprising. The Deciduous Forest Zone and Mixed Forest Zones, which incorporate climatic conditions favourable to deciduous species, are primarily located in the European region. In addition, harvesting previously concentrated in the European region, would have been located in the most accessible sites generally thought to support higher growth rates. Connected with the uncertain forest management practices, this would suggest that deciduous species are more likely. While similar arguments can be applied to the Pacific Asian region, the indigenous climate and lower rates of harvest are thought to both mitigate against the formation of stands of deciduous species.

¹⁰³Stocking class information is restricted to 156 million hectares containing the principal species located on the combined stocked forest land contained on Groups I, II, and III forests plus those forests allocated for long-term uses other than the production of timber. These forests are administered by either *Goskomles* or directly by the timber industry.

EUROPEAN STOCKED FOREST LANDS UNDER FOREST ADMINISTRATION BY SPECIES & SITE

Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 28

stocked forest land containing crown closure of between 80 and 100 percent. **Figure 29** shows the distribution of stocked forest land by stocking class within the European region.¹⁰⁴ Almost 26 percent of the region's stocked forest land is occupied by stands having the highest stocking class. In contrast, the share of lands with the minimal stocking are under represented, accounting for 9 percent of the stocked forest land of this region.¹⁰⁵

While accounting for nearly 30 percent of the stocked forest land, softwood deciduous species make-up 45 percent of the best stocking class. Coniferous species are much more dominant in the medium and poor stocking classes where they account for 69 percent and 77 percent respectively of the forested land.

Stocking class information is not available for the individual species for either the whole country or for the regions.

Age Classes

As is shown in **Figure 30**, only 35 percent of the European stocked forest land is mature and over-mature.¹⁰⁶ Coniferous species have an older age structure than the deciduous species. More than 40 percent of the stocked forest land area with coniferous species are in the mature and over-mature age classes versus 20 percent of the area in deciduous species.¹⁰⁷

In the near term, coniferous species (mainly spruce) will be replaced in the older age classes by both hardwood deciduous and softwood deciduous species, the major species being birch. In the two oldest immature age classes, hardwood and softwood deciduous species occupy 12 percent and 42 percent of the stocked forest land respectively. The share of coniferous species in the same two immature classes is 45

¹⁰⁴Table C42 shows the detailed stocking class data.

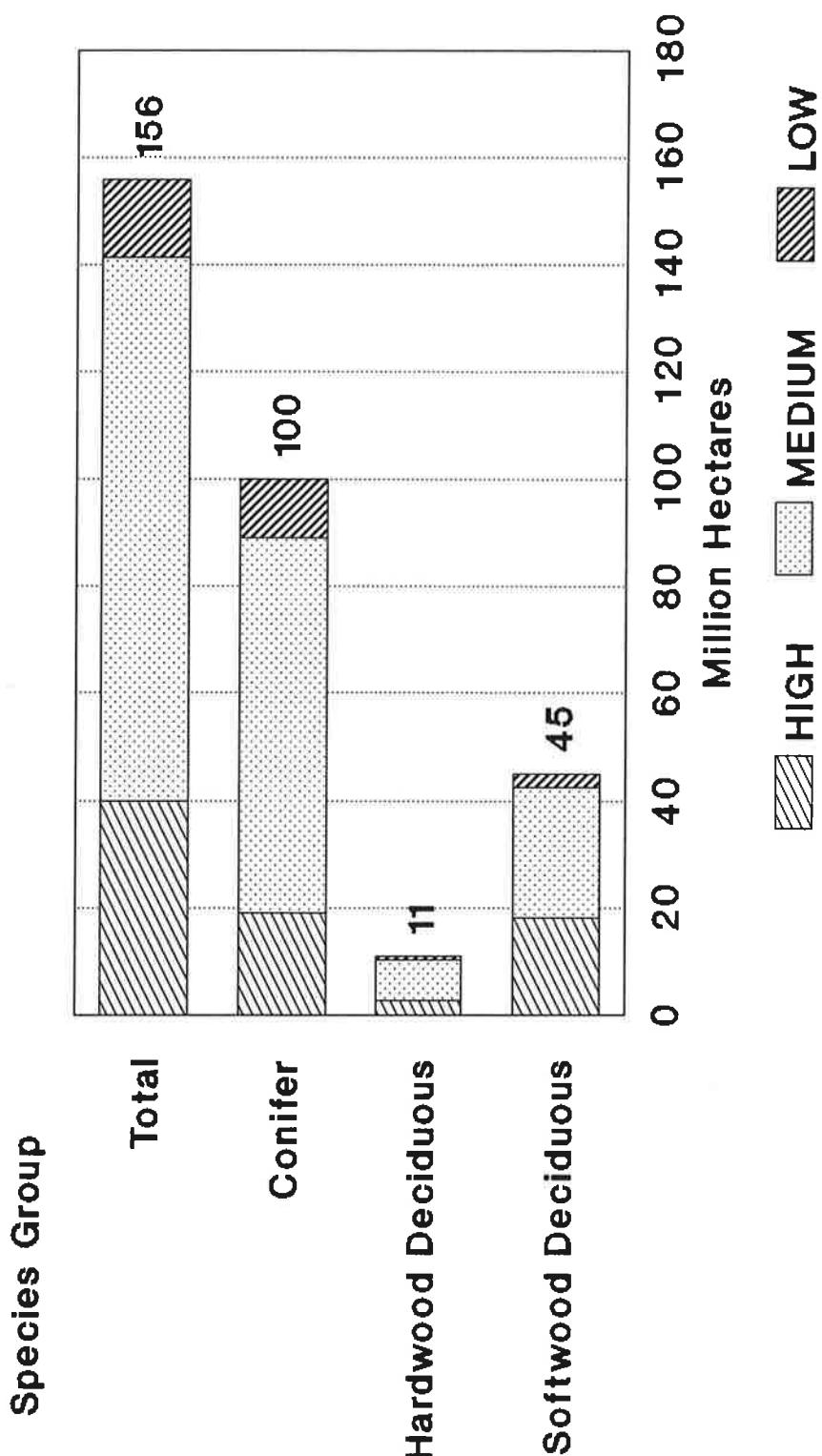
¹⁰⁵While the criteria used to classify stocking is far from clear at this time, on a general basis, area of any given site class can be more fully utilized and thereby have a higher stocking classification in a more developed part of the country. A higher level of forest management is possible solely due to access and greater proximity to populated areas and a labour force. The European region is the most developed of the four regions.

¹⁰⁶Detailed information concerning the age class distribution is delineated in Table C39.

¹⁰⁷The land base excludes forests allocated to long-term uses but includes the tree species which are not included in with any of the three major species groups. All of the land base is under the administration of primarily *Goskomles*.

EUROPEAN STOCKED FOREST LANDS UNDER FOREST ADMIN BY SPECIES & STOCKING

Ministry of Forestry and Forest Industry

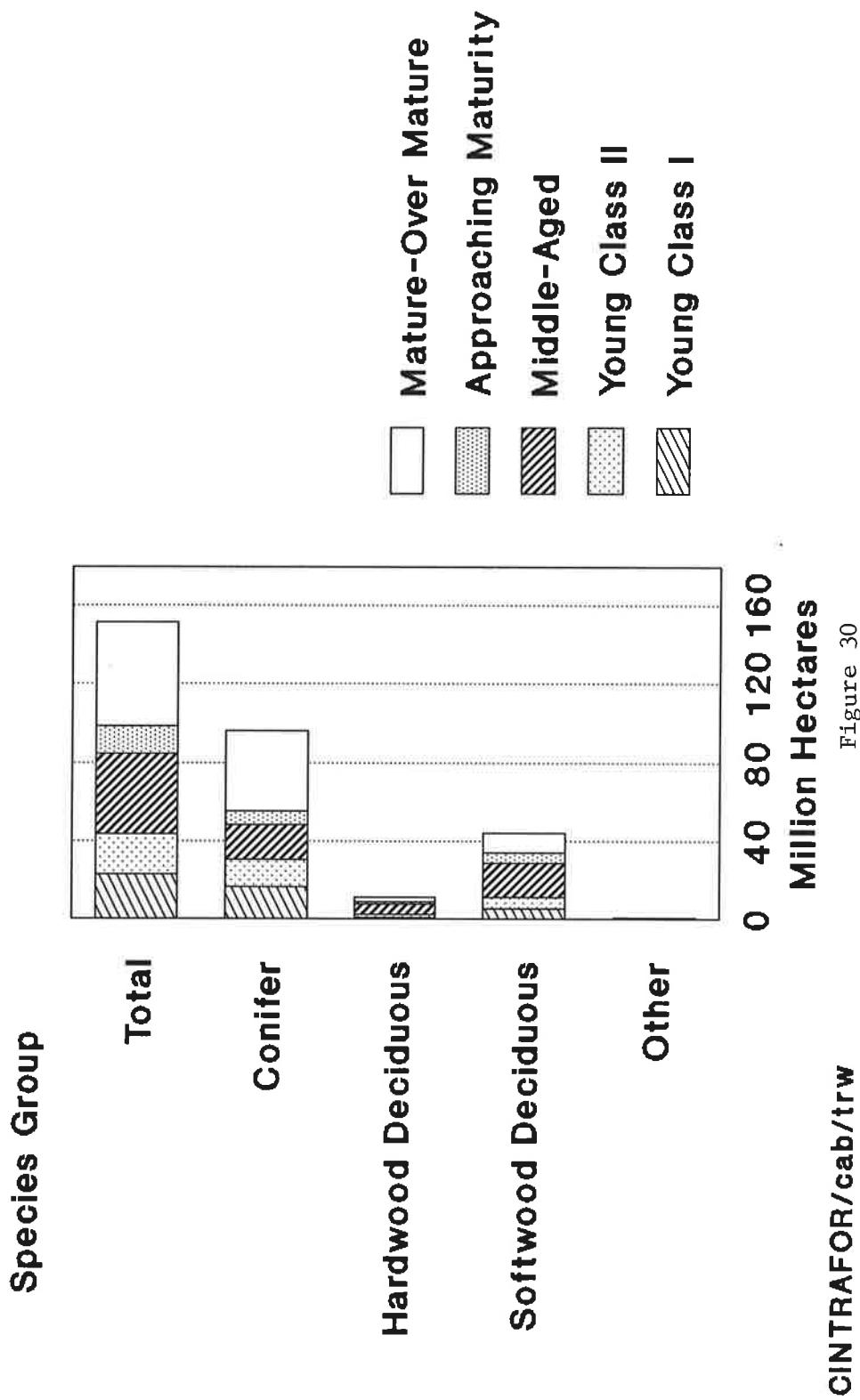


CINTRAFOR/cab/trw

Figure 29

EUROPEAN STOCKED FOREST LANDS UNDER FOREST ADMINISTRATION BY SPECIES & AGE

Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 30

percent (much less than the share of mature and over-mature stands which are accounted for by coniferous species - 77 percent). The share of coniferous species in the youngest two age classes is significantly higher approaching 70 percent of the stocked forest land. Thus, while coniferous species are expected to decline in the near to medium term, the longer term, in conjunction with proper forest management techniques, should witness an increase in importance.

While spruce makes up more than 50 percent of the forested area with mature and over-mature age classes, this species is less prevalent in the immature age classes. It accounts for between 12 and 30 percent of the area in immature forests. Pine, while accounting for 22 percent of the mature and over-mature stocked forest land, represents between 30 and 49 percent of the forested area in each of the four immature age classes. Thus, it is expected that pine will replace spruce as the forests of European USSR age and are harvested.

The principal softwood deciduous species are birch and aspen. Softwood deciduous species are expected to increase in the mature and over-mature age classes in the near to medium term. The increase will largely occur with birch species. Hardwood deciduous species are also expected in the near-term to increase but not nearly to the same extent as softwood deciduous species. The improvement is expected to occur primarily in oak and beech.

Mountain Forests

Tables C43 and C44 show that nearly half of the 21 million hectares of stocked forest land and 3 billion cubic meters of growing stock of mountain forests are located in Group I forests.¹⁰⁸ About one quarter is located in Group II forests with the balance located in Group III forests. Mountain forests allocated to long-term uses contain only 18 million cubic meters on 303 thousand hectares.

As shown in Tables C45 and C46, 150 million hectares or almost 15 percent of the land base in the European part of the USSR, consist of mountain forests reflecting the

¹⁰⁸The land base discussed here excludes the mountain forests allocated for long-term uses but includes species which are not specifically included with any of the three major species groups. It is believed that the mountain forests are simply a sub-set of the forests which have been allocated to Groups I, II, and III forests. A similar assumption applies to mountain forests allocated to long-term uses. As a result of this assumption, all mountain forests are thus thought to be under the administration by the forest authorities.

general lack of mountain systems and relatively flat terrain. While almost 65 percent of the stocked forest land is in immature age categories for the European region as a whole, mountain forests, as expected given the more inaccessible location, contain a lower share of stands in the immature age categories , estimated to be almost 60 percent.

As Figure 31 shows, slightly more than two-thirds of the mountain stocked forest land is occupied by coniferous species, less than the three-quarters occupied in the non-mountain forests. While hardwood deciduous species do not account for more than 5 percent of the forest resource in either mountain or non-mountain forests, tree species which do not belong to one of the three principal species groups amount to 14 percent of the mountain stocked forest land (but only an inconsequential share of the growing stock) and 3 percent of the non-mountain forested land. Softwood deciduous species occupy 12 percent of mountain forests and 18 percent of non-mountain forests.

The major coniferous species growing in mountain forests are spruce and true firs which together occupy 27 percent of the stocked forest land. Pine accounts for an addition 12 percent. Larch is conspicuously absent, occupying a nominal area of less than one percent. By contrast, species on lowland (non-mountain) forests are predominantly pine and spruce which account for 66 percent of the stocked forest land. The change in specie composition is related to the different climatic conditions encountered in mountainous regions versus the lowland. Lower temperatures, higher moisture and greater incidence of snow favour the true firs over pine species in mountainous regions.¹⁰⁹

Accessibility

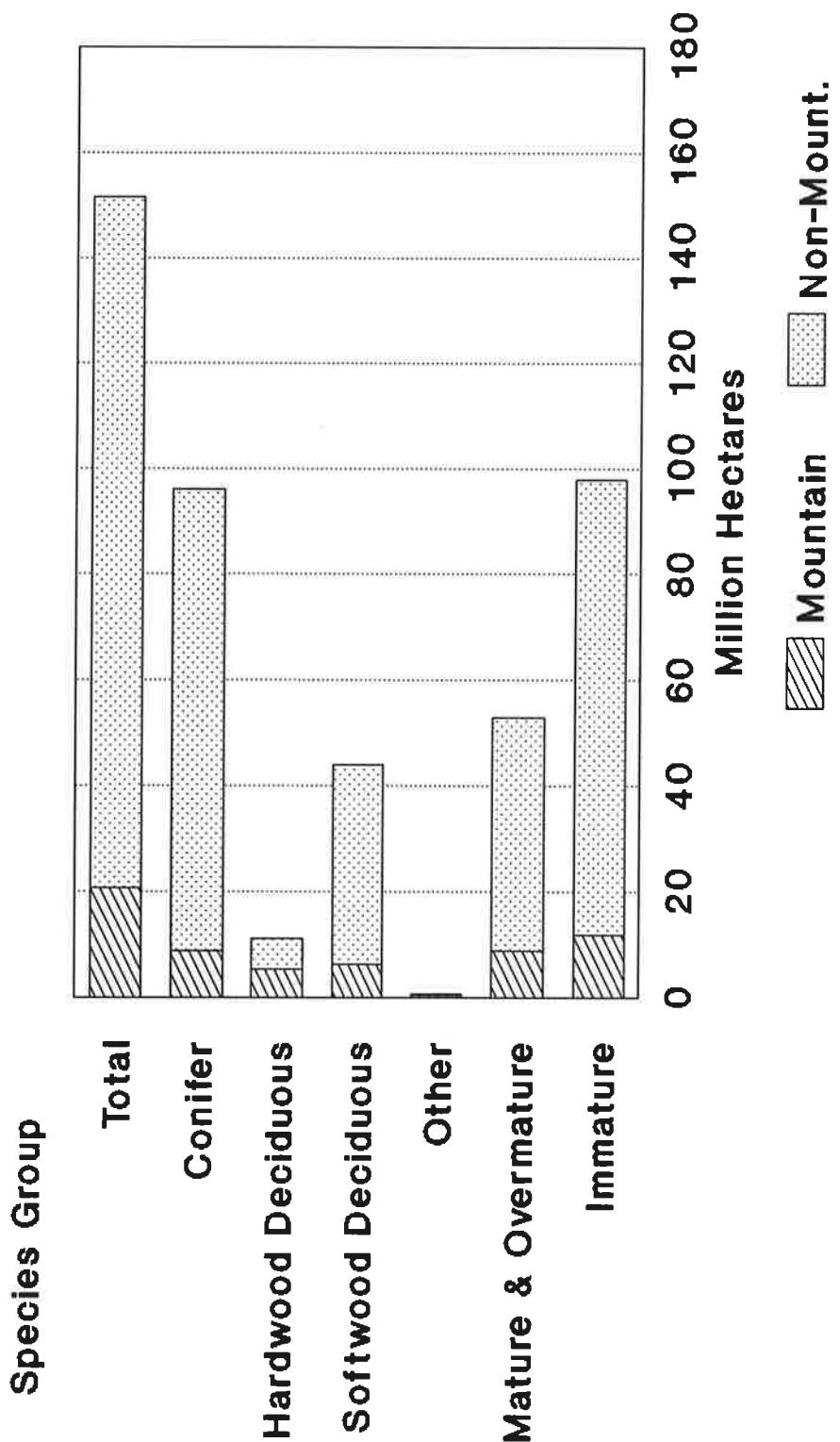
Table C35 and C36 showed that forest resources managed by Goskomles (excluding lands allocated to non-timber long-term uses) or directly by the timber industry amounted to almost 19 billion cubic meters of wood on 151 million hectares. Stocked forest land located on sites higher than or equal to 5 are believed to amount to 140 million hectares with nearly 19 billion cubic meters of forest inventory.¹¹⁰ Of this,

¹⁰⁹The share of the forest inventory contributed by each specie is based on the 1978 inventory. Species specific information is delineated on page 16 of Gorniye Lesa.

¹¹⁰The minimum site class thought by the Soviets to support industrial harvesting is site class 5.

EUROPEAN USSR STOCKED FOREST LANDS UNDER FOREST ADMINISTRATION BY SPECIES GROUP

Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 31

nearly 8.4 billion cubic meters on 53 million hectares is considered mature and over-mature.

One billion cubic meters of mature and over-mature growing stock (as was shown in **Figure 18** and Table C24), are presently unavailable for harvesting (believed not yet to be allocated to industrial enterprises), and thus could be theoretically allocated for future timber development. Most of reserve and inaccessible growing stock is located in Group I forests where the restrictions on harvest are the most severe. The balance is in Group II and Group III forests. A higher share of the reserve and inaccessible growing stock consists of coniferous species which account for 92 percent of the growing stock in Group III forests, 65 percent in Group II forests and 65 percent in Group I forests.

Thus, almost 90 percent of the European USSR's mature and over-mature volume is considered either currently or potentially accessible. (**Figure 19** and Table C25 showed the distribution of accessible and potentially accessible growing stock in the mature and over-mature age class category.) Almost 75 percent of the accessible mature and over-mature growing stock is located in Group III forests. Group II forests contain 18 percent or 1.4 billion cubic meters and Group I forests contain 8 percent or only 621 million cubic meters of currently and potentially accessible mature and over-mature timber. While accounting for 85 percent of the accessible mature and over-mature growing stock in Group III forests, coniferous species account for only 57 percent in Group II and 53 percent in Group I forests. Hardwood deciduous species do not form a significant share of the forest resource, accounting for a negligible share in group III forests and only 7 percent in Group II forests and 14 percent in Group I forests.

The accessible European resource (managed by the forest authorities) of 140 million hectares of stocked forest land and 18 billion cubic meters of growing stock support an allowable annual cut of about 240 million cubic meters.

In addition to the timber inventory in forests managed by *Goskomles* or directly by the timber industry, nearly 36 million hectares with 4.5 billion cubic meters are available from farm forests and forests of other ministries. Most this additional wood resource is believed to be accessible or potentially accessible. Nearly 900 million cubic meters on 5 million hectares are considered mature and over-mature.

Nearly 140 million hectares of stocked forest land and 18 billion cubic meters managed by the forest authorities support site classes considered to have industrial potential.¹¹¹ If farm forests and forests of the other non-forest and non-agricultural ministries are included with forest authority forests, nearly 180 million hectares containing nearly 23 billion cubic meters have potential for industrial development. The AAC supported by this forest resource is estimated to be 265 million cubic meters.

Allowable Annual Cut

While supporting thirty percent of the allowable cut of the USSR, the European part of the country accounts for nearly 40 percent of the allowable annual cut in currently and potentially accessible forests. Only 2 percent of the reserve AAC is allocated to the European USSR. For all intents and purposes, the AAC in this region is fully or potentially accessible. Soviet authorities credit an allowable cut of almost 265 million cubic meters to this region for all management classes. The AAC (from potential and currently accessible forests) from forests managed by either *Goskomles* or directly by the timber industry amount to 240 million cubic meters. The AAC from farm forests and forests under jurisdiction of non forest interests, amounts to almost 25 million cubic meters.

Goskomles and Timber Industry Allowable Annual Cut

As shown in Table C29, the AAC which originates from Group I and Group II forests, where the restrictions on harvesting are most severe, accounts for a large share of the total in this region.^{112, 113} Only 50 percent of the AAC comes from Group III forests. Group II forests support 35 percent and Group I forests support 13 percent of the AAC administered by the forest authorities. More than half of the AAC is coniferous species. Softwood deciduous species contribute 41 percent while hardwood

¹¹¹The thresh hold for stocked forest land to have industrial significance is site class 5 and higher. Forested Land with a site class category of 5a and lower is deemed not to have industrial significance.

¹¹²Information which divides the present AAC of 240 million cubic meters into the component forest groups is not available. Information which provides the division is available for *circa* 1980 when the AAC for the forest resource under control by the *Goskomles* or directly by the timber industry (forest authorities) throughout the USSR was 636 million cubic meters and for the European USSR - 250 million cubic meters.

¹¹³The AAC in the current and potentially accessible forest resource.

deciduous species contribute 4 percent. As would be expected, the highest share of coniferous species comes from Group III forests. The AAC from reserve and inaccessible forests amounts to 4.5 million cubic meters, nearly 90 percent of which is coniferous species. The reserve and inaccessible forest resource underlying this component of the AAC is believed to be under the administration of the forest authorities. Thus, the AAC under control of the forest authorities in both the accessible and potentially accessible forests as well as the inaccessible and reserve forests is almost 245 million cubic meters.

Future Outlook for the AAC

The forest authorities recognize the declining sustainability of the forest resource in the European USSR as shown in Table C30. Since 1980, the European AAC has decreased from 251 million cubic meters to 240 million cubic meters.¹¹⁴ While there is no detailed information of the changes within each species group or by group of forest, it is believed that most of the decline occurred in the coniferous component located in Groups II and III forests.

Recently, the impact of past harvesting practices and industrial pollution was examined for the European USSR.¹¹⁵ The study concluded that the current AAC overstated the long run sustainability of the harvest by at least 10 percent if industrial pollution and forest management practices continued unabated. Thus, the realistic outlook for the AAC supported by the forest resource managed by either *Goskomles* or directly by the timber industry is no more than 215 million cubic meters, almost 25 million less than the current level. Correspondingly, the revised AAC supported by the forest resource managed by all organizations amounts to 240 million cubic meters.

HARVEST

As Table C31 shows, wood deliveries from the European USSR have declined since 1960 when 276 million cubic meters of timber was produced.¹¹⁶ By 1985, deliveries

¹¹⁴The AAC is that which is under control of the forest authorities in the current and potentially accessible forest resource.

¹¹⁵The forest resource investigated seems to have been the total forest fund independent of management organization. The study was conducted by IIASA.

¹¹⁶This volume is produced within the "planned" system, and excludes collective farm harvest and harvest by the small harvesting units not specifically attached to the planned system. The

had decreased to 228 million cubic meters. By 1989, the output had moderated by 10 million cubic meters to an annual levels of 239 million cubic meters.

Almost 194 million cubic meters of the 1989 total originated from mature stands (under management by the forest authorities) using either the clearcutting or selective cutting methods of harvesting under the principal utilization. While detailed information about the harvest segregated into the respective species groups is unavailable, it is believed that the current practices are similar to that existing for 1982 as shown in Table C32. Coniferous species accounted for 62 percent of the harvest while softwood deciduous species and hardwood deciduous species accounted for 35 percent and 3 percent respectively. The share of coniferous species is less in the European USSR region than in the Pacific Asian USSR region but similar to that experienced in Transition RSFSR region.¹¹⁷

Almost 38 million cubic meters of harvest originate in European USSR from intermediate utilization. Harvest from other utilization is thought to amount to about 10 million cubic meters. The total harvest is thus considered to be at least 242 million cubic meters. Species distribution of the harvest under both intermediate and other utilization is not available, although it is believed to be weighted towards coniferous species.

Utilization of the AAC

As would be expected, the utilization of the AAC in the European USSR region is much greater than in any of the other three regions. Based on information dating from the harvest in 1982, nearly 77 percent of the AAC was utilized.^{118, 119} Utilization varied from 89 percent for coniferous species to 69 percent for hardwood deciduous species and 63 percent for softwood deciduous species. While similar detail on species group utilization is unavailable for recent years, by 1989, the overall utilization rate

regional distribution of the harvest from collective farms and from small operators is not available.

¹¹⁷The similar proportion of each species group in the harvest derived from principal utilization between European USSR and Transition RSFSR contributed to the separation of Transition RSFSR or West Siberia from the rest of Asian USSR called here Pacific Asia.

¹¹⁸This information is believed to still be current at least with respect to the shares of both total AAC utilized as well the shares of the AAC contributed by each of the three species groups,

¹¹⁹AAC is under control of the Forest Authorities.

had climbed to 80 percent solely due to the drop in the AAC to 240 million cubic meters from 250 million cubic meters.

Information detailing harvest from each group of forests and by geographic region is not available. However, given the overall utilization rate experienced in 1989, it is expected that the AAC of (circa 1980) 132 million cubic meters in Group III forests, 87 million cubic meters in Group II forests and 32 million cubic meters in Group I forests to be generally fully utilized.

While regional distribution of the harvest from collective farms and small operators is not available, it is believed that this component of AAC is fully utilized.

REGENERATION

Regeneration accomplishments on a regional basis are not available. However, most of the fire damage is believed to be located in Pacific Asia.¹²⁰ Thus, it is expected that, given the "official" balance between harvest and restocking which exists on the national level, the European USSR is also in balance.

PROGNOSIS

In the short to medium term, any increases in the European regional harvest cannot be expected to come from extensive forms of forest development. Most of the reserve volume is thought to be located on mountain forests in the northern and eastern reaches of this region. Since the European USSR region has supported the majority of the harvesting in the past, we believe that forest land not yet allocated to industrial enterprises is relatively high cost wood. If it has not been allocated by now in preference to forests in Siberia, either environmental or economic barriers exist to its development. Clearly then, extensive development of hitherto virgin forest land cannot be expected to contribute significantly to the future timber supply of this region.

Group I forests contain almost 2 billion cubic meters of mature and over-mature growing stock. At the present time, only 621 million cubic meters are thought to be accessible or be potentially accessible. Of the volume which is currently considered reserve and inaccessible, an unknown, though very real volume is believed to be

¹²⁰Lesnoye Khozaustvo, page 92

accessible but where harvesting is simply not permitted. By changing the regulations governing the harvest in Group I forests, Soviets believe that an additional annual harvest of 10 million to 12 million cubic meters is possible from Group I forests.¹²¹ It is believed that two-thirds of the incremental volume would be coniferous species.

The most likely increases will occur from currently developed stands where deciduous species predominate. While only 90 percent of the European region's AAC from coniferous species is presently utilized, we believe that the remaining 10 percent is not environmentally or economically viable. In fact, the unrealized ten percent approximates the fall down of the AAC due to pollution and poor forest management practices cited earlier. Potential increases amount to 28 million cubic meters of softwood deciduous species and 2 million cubic meters of hardwood deciduous species.¹²²

While increases from intermediate utilization are possible in the long-term, lack of technology and higher cost will discourage increases in the near to medium term in the absence of financial incentives. In the long-term, however, the Soviets believe that an additional harvest using new technology and proper incentives may increase the intermediate harvest by 25 million to 30 million cubic meters.¹²³ The majority of the incremental timber output would likely consist of coniferous species. While other utilization can be expected to increase as economic development proceeds, the near to medium term is not expected to see large volume increases.

On balance, we believe that the upside potential for European harvest can be expected in the near to medium term to be no more than 40 million cubic meters. Nearly four-fifths of the incremental harvest would consist of deciduous species, primarily birch and aspen. In the longer-term, new technology coupled with financial incentives to

¹²¹Petrov, A.P., Management and Organization of Forest Industries and Forestry in the USSR, MacMillan Lectureship Series # 40, University of British Columbia, 1989, page 8

¹²²Nearly 90 percent of the AAC for coniferous species, 69 percent for the hardwood deciduous species component and 63 percent for the softwood deciduous species component were utilized in 1982. We believe that these figures are appropriate for the present time. If the utilization rates of the deciduous species were to increase to 90 percent, this would generate about 30 million cubic meters of wood.

¹²³Petrov, A.P., Management and Organization of Forest Industries and Forestry in the USSR, MacMillan Lectureship Series # 40, University of British Columbia, 1989, page 8

encourage more intermediate utilization could lead to another 25 million cubic meters, most of which should be coniferous species.

On a regional basis, there appears to be sufficient unutilized AAC to accommodate the expected decline of the approximate 25 million cubic meters discussed earlier. However, this unutilized AAC is believed to have economic or environmental impediments to its use. Thus, the anticipated decline in harvest (primarily in coniferous species) stemming from a reduction of the AAC is expected to be compensated for by the increase in the deciduous harvest.

With the expected increase in deciduous harvest and the rise in the output from Group I forests, the AAC and the harvest in the European region should be nearly completely balanced. Thus, there is no reserve to meet unexpected declines in the carrying capacity of the resource brought on by natural or man made events.

TRANSITION RSFSR

THE FOREST RESOURCE

Overview

The Transition RSFSR region (or West Siberia) contains 12 percent of the total land area in the forest fund, but only 10 percent of the forest land and 11 percent of the stocked forest land. However 13 percent of the growing stock or 10.6 billion cubic meters. An estimated 40 percent of the growing stock is classified as mature or over-mature. While containing one-fifth of the nation's mature and over-mature timber, this region accounts for 28 percent of the accessible and potentially accessible mature and over-mature volume. The average stocking per hectare regardless of accessibility is 142 cubic meters per hectare in mature and over-mature stands and 97 cubic meters per hectare in immature stands. Tables C27 and C28 provide a regional breakdown of the forest resources of the Soviet Union.

Administrative Responsibilities

As is evident from **Figures 32 and 33**, slightly over 80 percent of the 90 million hectares of stocked forest land and 10.6 billion cubic meters of growing stock is under the control of the forest authorities (excluding forests allocated for long-term uses).¹²⁴ Only a nominal amount of this is directly administered by the forest industry. Stocked forest land which is managed for near and short term timber production of goods and services, including those for the forest industry, accounts for 74 million hectares and 9 billion cubic meters.

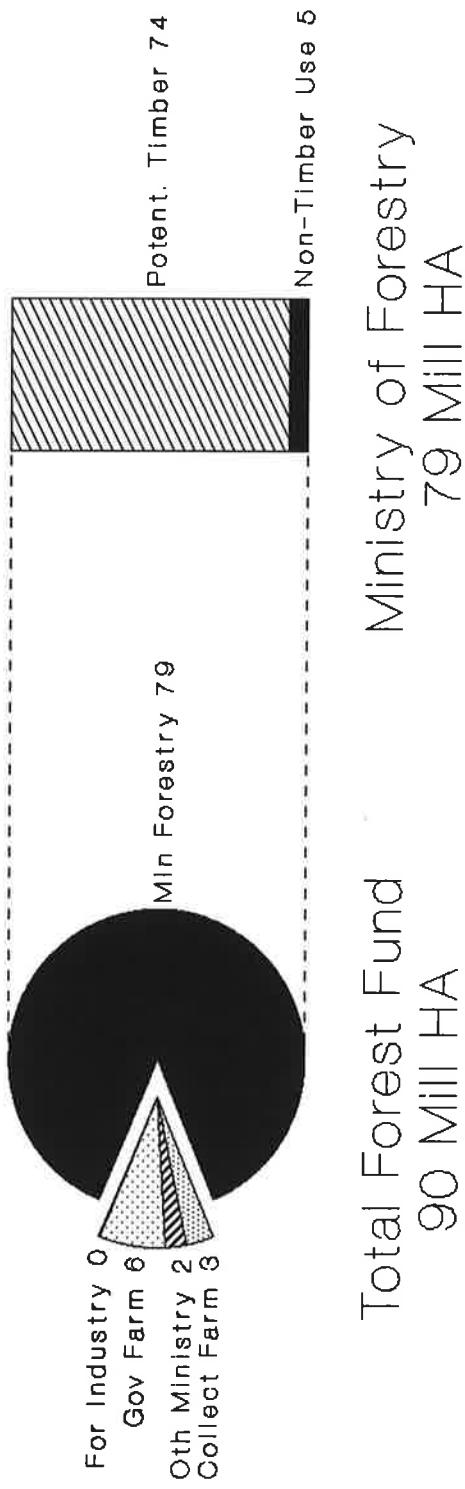
Forests under the administration of either the collective farms or the government farms account for 10 percent of the forest resource. While the balance is primarily under the control of *Goskomles*, it has been allocated to long-term uses other than the production of timber.

Nearly 60 percent of the stocked forest land and two-thirds of the growing stock (under management by the forest authorities but excluding forests allocated for long-term uses) are considered mature and over-mature. This is in stark contrast to farm forests where less than one-quarter of the forest inventory is mature and over-mature. Forests allocated for long-term uses contain an even higher share in the

¹²⁴Tables C47 and C48 provide a more detailed presentation of the data.

TRANSITION USSR FOREST LANDS BY MAJOR MANAGEMENT ORGANIZATION

Million Hectares

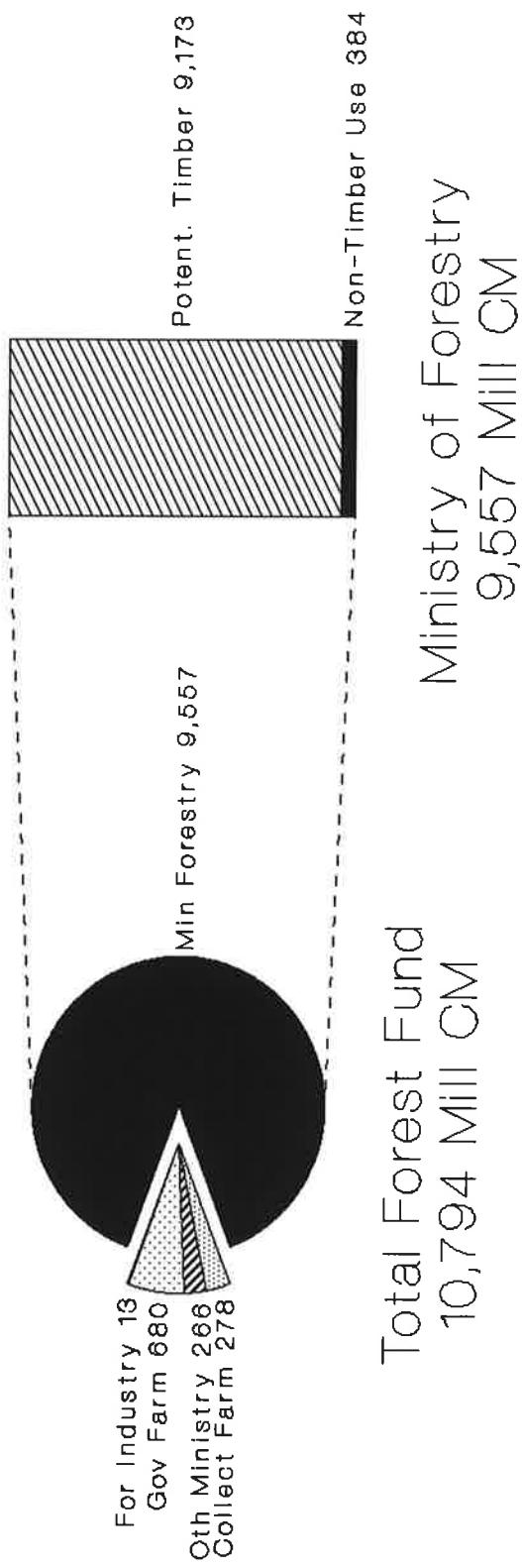


CINTRAFOR/cab/trw

Figure 32

TRANSITION USSR FOREST INVENTORY BY MAJOR MANAGEMENT ORGANIZATION

Million Cubic Meters



CINTRAFOR/cab/trw

Figure 33

mature and over-mature category amounting to nearly 70 percent of both the forested land and growing stock.

Farm forests, as would be expected, have a disproportionately high share of the forest resource in the Transition RSFSR region than for the USSR as a whole. They account for 10 percent of the forest resource of the region in contrast to only 5 or 6 percent at the national level. While collective farms and government farms were equally represented in the European part of the USSR, in the Transition RSFSR region, government farm forests outnumber collective forests by a margin of two to one. Farm forests account for 9.5 million hectares of forest land, 9.2 million hectares of which is considered stocked forest land and almost one billion meters of timber. Not surprisingly, four fifths of the stocked land area and three quarters of the growing stock are classed as immature, following the pattern evidenced for the European region of the USSR. Farm forests support a lower volume per hectare in mature and over-mature forests than forests managed by the forest authorities (134 cubic meters per hectare versus 148 cubic meters per hectare) and almost equal volumes in the immature age classes (97 cubic meters per hectare versus 96 cubic meters hectare).

Farm forests, as in the European region, consist of predominantly deciduous species which occupy over 80 percent of the stocked forest land and include 80 percent of the growing stock. Nearly all of the deciduous resource consist of softwood deciduous species. While coniferous species have an older age structure than the softwood deciduous species, in which species group nearly 80 percent of the stocked forested land is immature, still 65 percent are considered immature.

Forests allocated to non-timber long-term uses amount to 5 million hectares of stocked forest land and 384 million cubic meters of growing stock. Almost 90 percent of the forest inventory consists of coniferous species. Hardwood deciduous species are not significantly present in this region. As can be expected given the non-industrial orientation of these forests, stocking is quite low - below 80 cubic meters per hectare.

Land Under Control of the Forest Authorities

Slightly over 73 million hectares of stocked forest land supporting 9 billion cubic meters of growing stock is managed by the forest authorities.¹²⁵ Nearly 41 million hectares and 6 billion cubic meters are considered mature and over-mature. The forest resource managed directly by the timber industry is not very large amounting to only 84 thousand hectares.

The stocking in the mature and over-mature age classes is quite high amounting to 148 cubic meters per hectare. Stocking in immature age classes amounts to nearly 100 cubic meters per hectare. While the stocking is less than in the European region, it is higher than the minimum stocking levels believed to support economical harvesting activity. This level is 140 cubic meters per hectare.

The Primary Use For Forests - The Forest Groups

As **Figure 34** clearly shows, of the nearly 79 million hectares of forest land in Transition Asia, nearly 95 percent of 74 million hectares are considered stocked. Only 6 percent of the land area is unstocked (or slightly over 4 million hectares).¹²⁶ An insignificant area is located in immature plantations, nurseries, and other unspecified categories of forest land. **Figure 35** indicates the distribution of unstocked forest land to consist primarily of glades or small openings in the forest canopy accounting for slightly more than 2 million hectares or 51 percent of the unstocked area.¹²⁷ The balance consists of mainly fire damaged timber (one million hectares or 23 percent) and cutover land not yet supporting a new crop of trees (900 thousand hectares or 20 percent).

Nearly 80 percent of the stocked forest land (or 63 million hectares) is located in Group III forests.¹²⁸ Group I forests account for 16 percent or 16 million hectares while Group II forests account for only 4 percent or 4 million hectares. The Transition

¹²⁵The forests allocated to non-timber long-term uses are under the administration of *Goskomles*, but have no industrial significance. These forests are excluded from the following discussion about the forest resource of the Transition RSFSR region, re-emerging only for the sections dealing with site and stocking class.

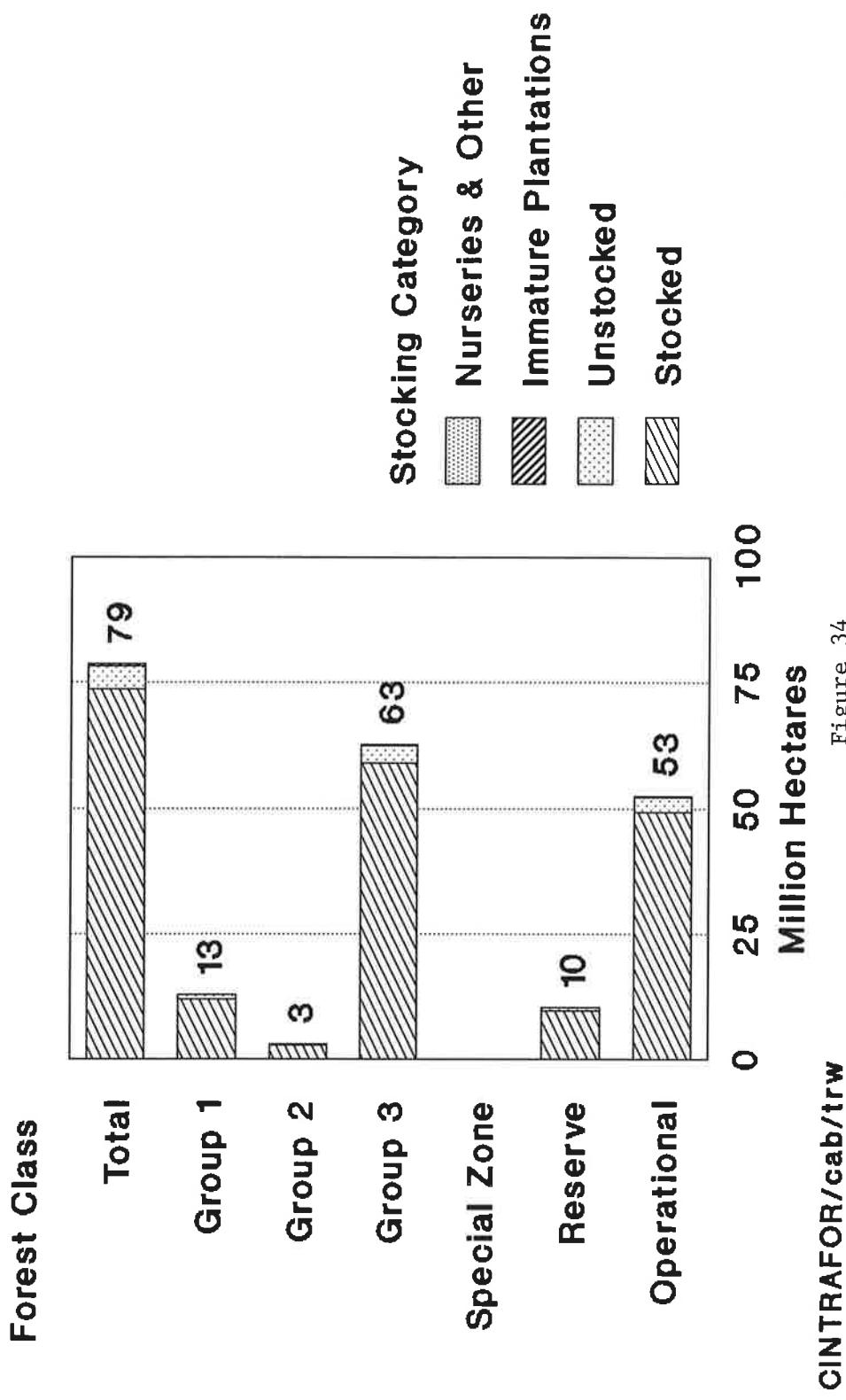
¹²⁶Table C49 provides more detail.

¹²⁷Table C50 shows in greater detail unstocked forest land of Transition RSFSR.

¹²⁸Information concerning growing stock is not available for individual group of forest.

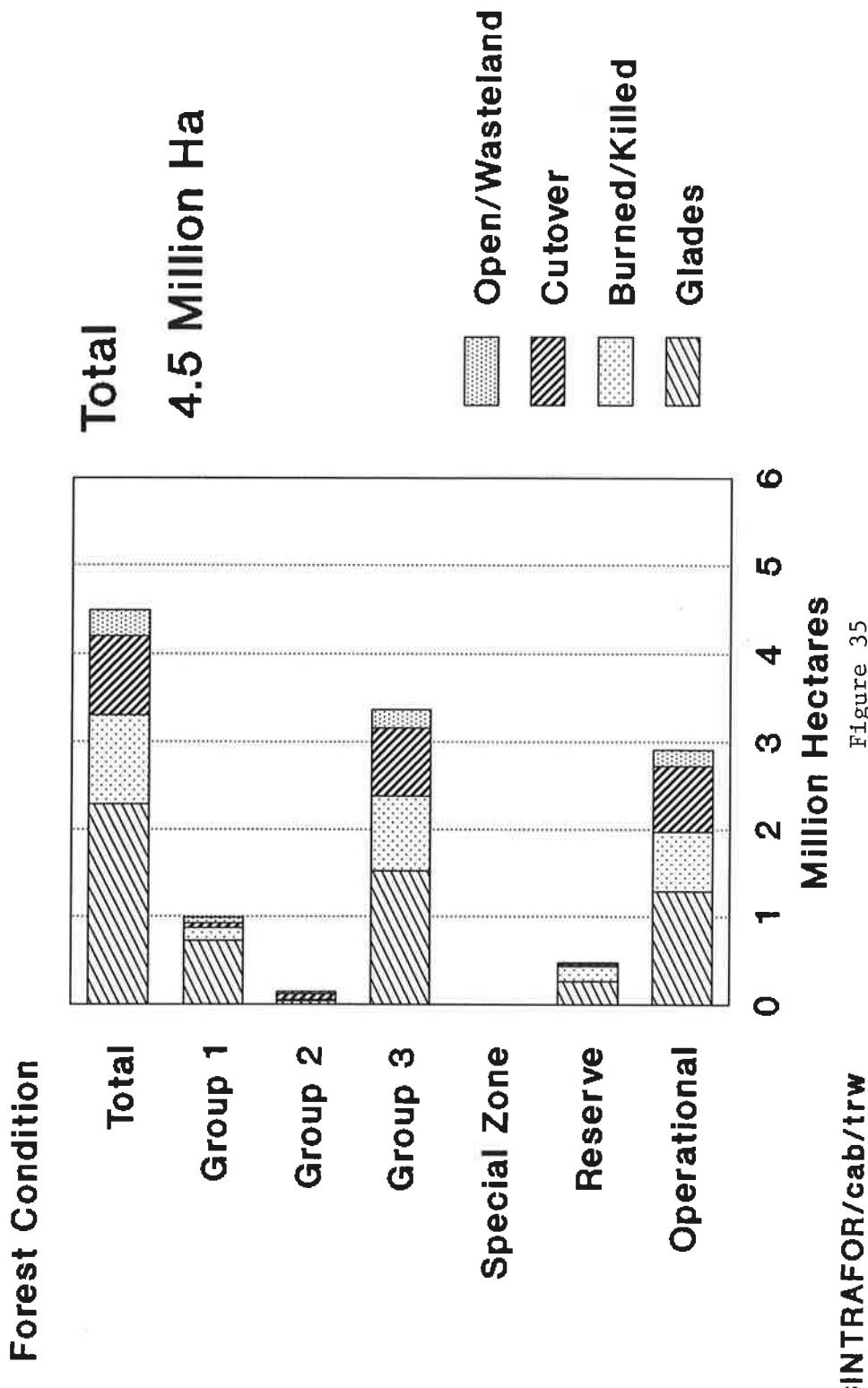
TRANSITION USSR FOREST LAND UNDER FOREST ADMINISTRATION BY STOCKING

Ministry of Forestry and Forest Industry



TRANSITION REGION UNSTOCKED FOREST UNDER FOREST ADMINISTRATION BY CONDITION

Ministry of Forestry and Forest Industry



RSFSR region accounts for what is a much larger share of the reserve forests in Group III than does the European USSR, although it is still a diminutive amount. Reserve forests in the Transitional RSFSR amount to almost 10 million hectares or 5 percent of all reserve forests in the USSR. Unstocked forest land accounts for between 5 percent and 8 percent of the forest land within each of the three groups of forests, almost twice that in European USSR.

Table C50 shows the distribution of the unstocked forest land into four categories. Unstocked forest land arising from fires and harvesting account for nearly half of the total. Most of the remainder arises because of glades and small openings in the stand cover. A higher share of the unstocked forest land in Group I and Group III forests is attributed to glades and small openings than in Group II forests. Nearly 50 percent of the unstocked forest land in Group II forests is accounted for by lands harvested but not yet supporting another crop of trees.

Species

Figures 10 and 11 provided an indication of the distribution of stocked forest land among the principal species groups.¹²⁹ Coniferous species account for 56 million hectares of stocked forest land while softwood deciduous species account for 22 million hectares, representing 70 percent and 29 percent of the regions total respectively.¹³⁰ Hardwood deciduous species account for an insignificant amount of the forest resource. The stocked forest land on which coniferous species are growing support 6.8 billion cubic meters of inventory while the areas growing softwood deciduous species support a volume of 2.8 billion cubic meters.

The major coniferous species are pine and cedar pine which account for 37 percent and 16 percent of the stocked forest land and 31 percent and 22 percent of the growing stock. Birch and aspen comprise nearly all of the softwood deciduous species resource. Birch accounts for 22 percent of the stocked forest land and 21 percent of the growing stock while aspen occupies 6 percent and 8 percent respectively.

¹²⁹Refer to Tables C33 and C34 for a more detailed presentation of the species distribution.

¹³⁰The detailed information concerning species distribution used for the description of the USSR and the European USSR is not available for Transitional RSFSR. The basis for this section includes all stocked forest land and growing stock allocated to management by the forest authorities (including forests allocated to non-timber long-term uses). The forest resource not specifically included in with any of the three species groups is excluded.

Site Class

A disproportionate share of the lowest site lands are located in the Transition RSFSR region. While containing 12 percent of the stocked forest land, Transition RSFSR contains 18 percent of the site classes below 5.¹³¹ As Figure 36 shows, almost 18 million hectares of the total 78 million hectares are accounted for by this site class alone.^{132, 133}

Two thirds of the stocked forest land are located in site classes 3, 4, and 5. Of the 78 million hectares, almost 80 percent or 61 million hectares grow on sites greater than or equal to site class 5, the minimum site class to be considered to have industrial significance.

Coniferous species dominate site classes 4, 5, and 5a and lower where they represent 73 percent, 86 percent, and 92 percent of the total forested land in each category. More than 80 percent of the coniferous species are located in the three lowest site classes. Deciduous species on the other hand are located in site classes 2 and higher, 3, and 4 in which more than 60 percent of the stocked forest land of deciduous species are located. More than 70 percent of the deciduous species are located in site classes 2 and higher and 3.

Stocking Class

Figure 37 shows the distribution of the stocked forest land by stocking class categories.^{134, 135} Contrasting with European USSR where 26 percent of the stocked

¹³¹ Site class information is restricted to 78 million hectares containing the principal species located on stocked forest land contained on Groups I, II, and III forests plus forests allocated for long-term uses other than the production of timber. These forests are administered by either *Goskomles* or directly by the forest industry.

¹³² Table C51 presents more detailed information concerning the distribution of stocked forest land among the different site classes.

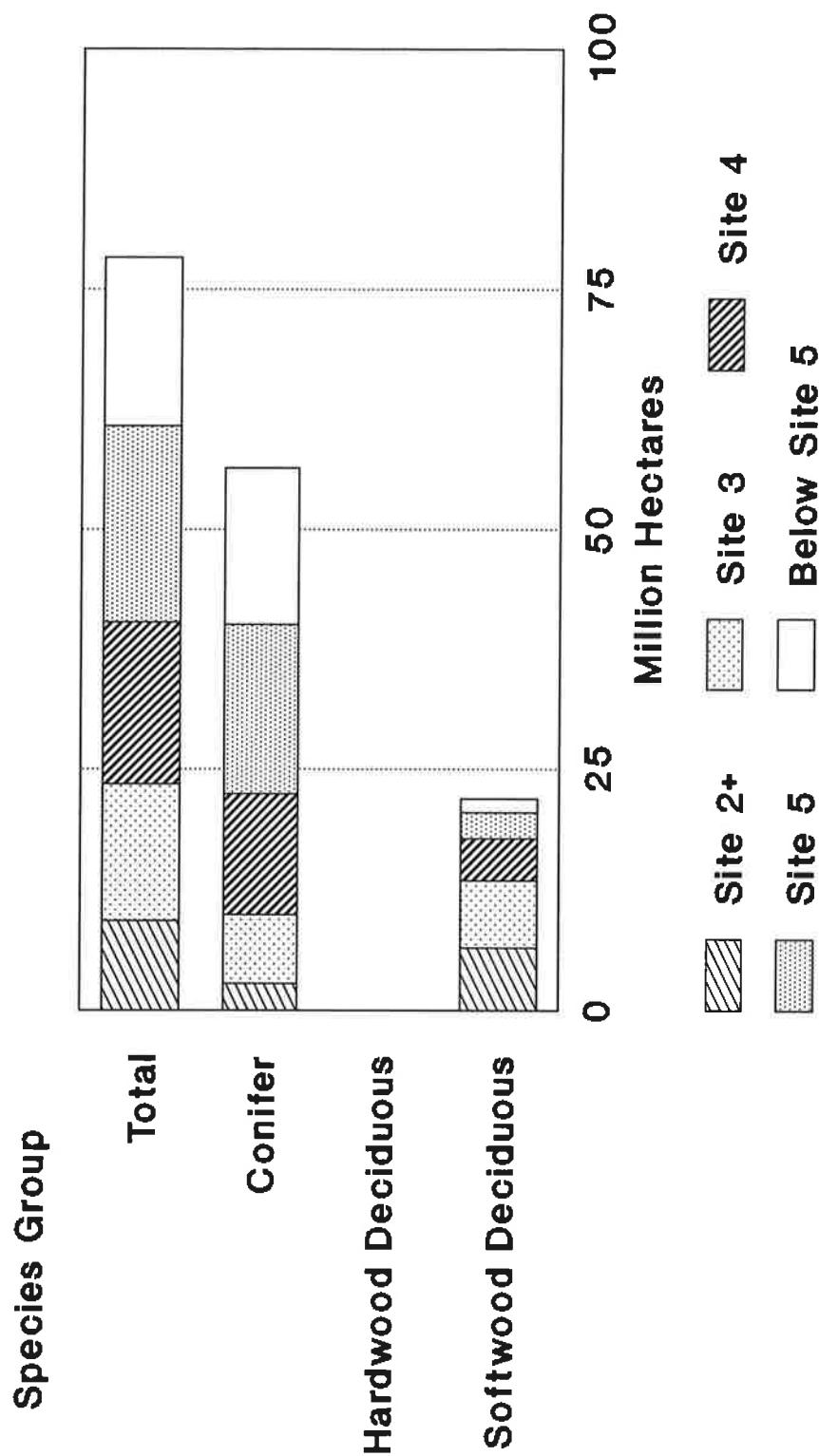
¹³³ The higher proportion of the lowest site class located in the Transition RSFSR region is due to the existence of large areas of swampy and partially undrained land.

¹³⁴ Table C52 shows distribution of stocked forest land among the three stocking classes in more detail.

¹³⁵ Stocking class information is restricted to 78 million hectares containing the principal species located on stocked forest land contained in Groups I, II, and III forests plus forests allocated for non-timber long-term uses. These forests are administered by other *Goskomles* or directly by the forest industry.

TRANSITION STOCKED FOREST LANDS UNDER FOREST ADMINISTRATION BY SPECIES & SITE

Ministry of Forestry and Forest Industry

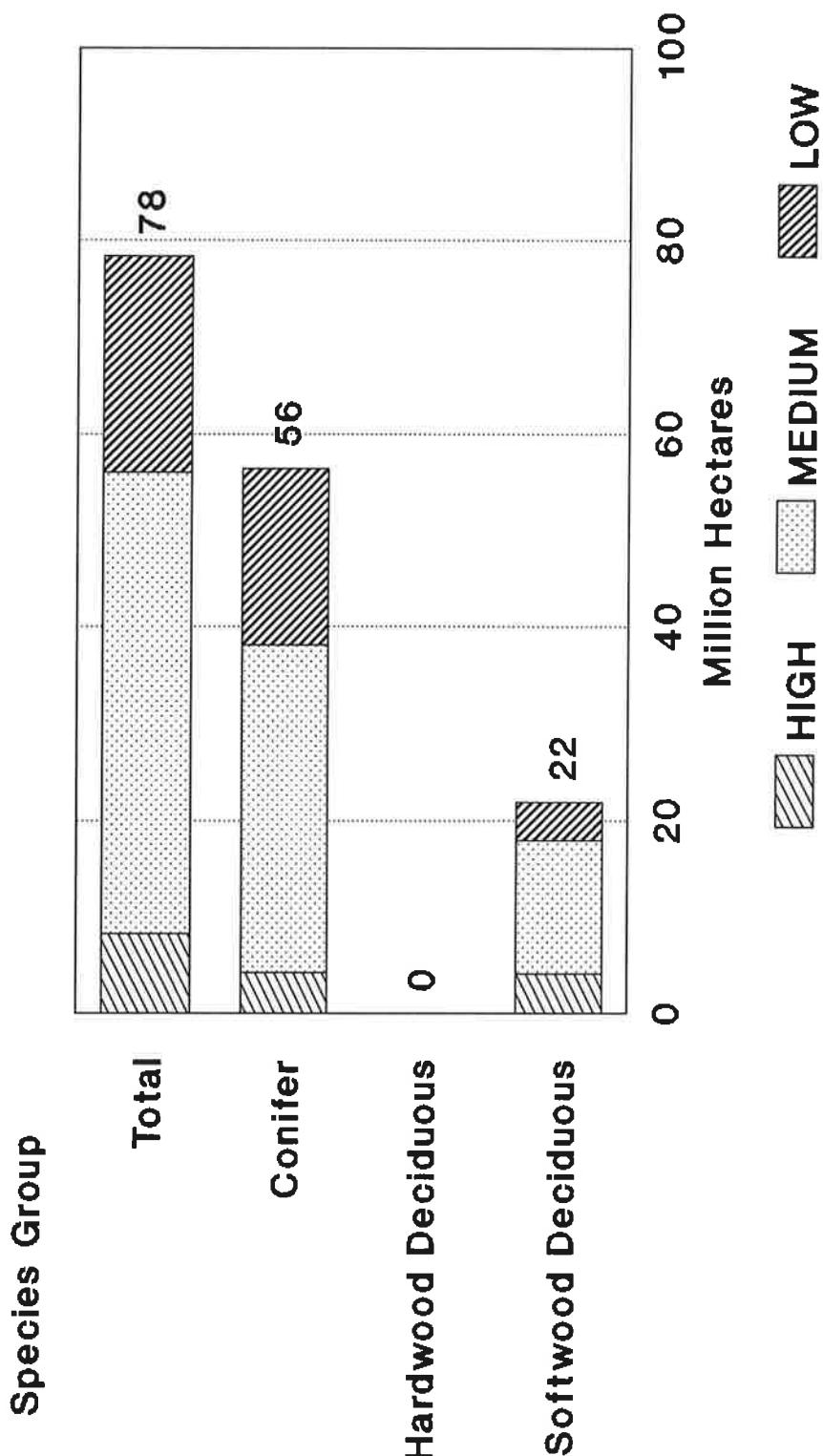


CINTRAFOR/cab/trw

Figure 36

TRANSITION STOCKED FOREST LANDS UNDER FOREST ADMIN BY SPECIES & STOCKING

Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 37

forest land is considered to have full stocking, only 11 percent of the Transition RSFSR's forested land is so classified. While most of the stocked forest land is located in the medium stocking category, a significant share (28 percent) of stocked forest land is classified as having poor stocking. The European USSR region, on the other hand, contains only 9 percent of the stocked forest land in the poor stocking class. Not surprisingly, while approximately 60 percent of each species group is located in the medium stocking classes, a higher share of the forested land under deciduous species than under coniferous species is located in the highest stocking class.

Age Classes

Detailed information about the age class structure of the forests in Transition RSFSR is not available.¹³⁶ Based on inventory data which segregates the species groups into a mature and over-mature category and an immature category (shown in **Figure 38**), the forest resource is older than the European resource. While only 32 percent of the stocked forest land in the European USSR is mature and over-mature, in the Transition RSFSR, this age class contains 56 percent in mature and over-mature age classes. The age structure does not change materially for individual species groups.

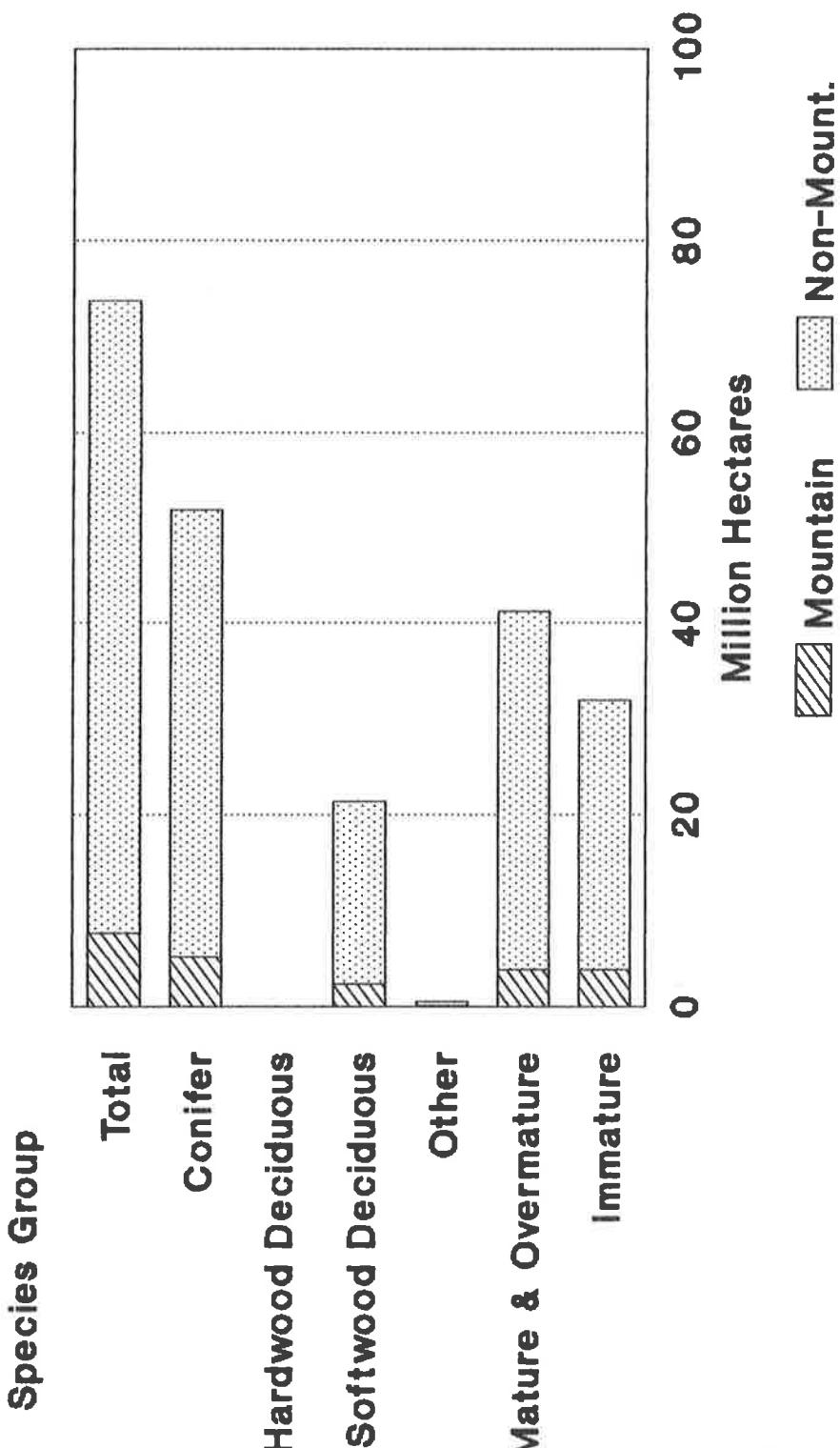
The larger share of mature and over-mature forested area in the Transition RSFSR region than in the European USSR region is connected to the historic distribution of the harvesting activities. As pointed out in the harvest section in the European USSR region, most of the harvest has taken place in the European USSR and it is only recently that the harvest has shifted to the east. Thus it is not surprising to see an older age class structure in the Transition RSFSR than in the European USSR.

Mountain Forests

Tables 53 and 54 show that most mountain forests fall into Group III. Only 14 percent are located in Group I forests and 6 percent into Group II forests. The stocking in mountain forests is higher than the figures for the total forested land. Coniferous species account for two-thirds of the stocked forest land and almost three-quarters of the growing stock. Nearly 60 percent of the forest resource is mature and over-mature. The stocking in mature and over-mature stands is 158 cubic meters per

¹³⁶Since information about the age class distribution of the forest resource is not available to the same level of detail available either for the USSR or European USSR, the general division between immature and mature and over-mature available from data about the forest fund in Transition RSFSR has been used.

**TRANSITION USSR STOCKED FOREST LANDS
FOREST ADMINISTRATION BY SPECIES GROUP**
Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 38

hectare and 108 cubic meters per hectare for immature stands. Non mountain forests in comparison show stocking of 147 cubic meters per hectare and 98 cubic meters per hectare.

Figure 38 showed that in Transition RSFSR, only 10 percent of the estimated forest resource available for the forest industry is accounted by mountain forests.¹³⁷ This is the lowest of any of the four regions. Given the small contribution of mountain forests to the inventory of Transition RSFSR, it is not surprising to see that mountain forests amount to no more than 10 percent of total Group I forests, 17 percent of total Group II forests and 10 percent of Group III forests.

While spruce and true firs account for 40 percent of the stocked Forested land in mountain forests, larch is a sizeable contributor amounting to 12 percent. The main species on the non-mountain forests in comparison are spruce and pines. The differences between mountain forests and non mountain forests are connected to climatic conditions including temperature and precipitation changes inspired by changes in elevation.

Accessibility

Tables C47 and C48 showed that there are 74 million hectares of stocked forest land and 9 billion cubic meters of growing stock in this region which are managed by the forest authorities (excluding forests allocated to non-timber long-term uses). Only 10 million hectares are classified as reserve forests. **Figure 18** showed that the reserve forests support a mature and over-mature volume of one and a half billion cubic meters.¹³⁸ Presently, it is believed these forests have not yet been allocated to industrial organizations.

Nearly 64 million hectares of stocked forest land (managed by the forest authorities) are presently either accessible or expected to become accessible for timber

¹³⁷Tables C55 and C56 present a more detailed picture of the mountain and non-mountain segregation of stocked forest land and growing stock.

¹³⁸The AAC in reserve forests located in Transition RSFSR is 13.74 million cubic meters. The total AAC in reserve forests throughout the Asian USSR is 197 million cubic meters. The total mature and over-mature Growing stock considered to be in reserve is 22 billion cubic meters. Thus, the amount situated in Transition RSFSR is $\{(13.74/197)*22\}$ one and a half billion cubic meters.

production within the next 15 to 20 years.¹³⁹ However 13 million hectares of this total are believed to be in the lowest site class category (5a and lower).¹⁴⁰ Thus, the forest inventory which meets the thresh hold site class for industrial potential amounts to 51 million cubic meters. The exploitable mature and over-mature volume, shown in **Figure 19**, is estimated to be 5.5 billion cubic meters.¹⁴¹ This represents 90 percent of the mature and over-mature growing stock. Nearly 35 percent of this volume is believed to be softwood deciduous species. This forest inventory supports an AAC of 103 million cubic meters.

In addition to the accessible and potentially accessible resource administered by the forest authorities, nearly 9 million hectares of stocked forest land supporting approximately one billion cubic meters is located on farm forests. No more than one-quarter of this resource is mature and over-mature however, and almost 80 percent consists of softwood deciduous species. All of this land is believed to be currently accessible. The forest resource from other non-forest agencies is not significant within this region.

Thus, the potential and currently accessible stocked forest land is estimated to amount to 60 million hectares, containing 6.5 billion cubic meters of mature and over-mature growing stock. Nearly 65 percent of the mature and over-mature growing stock are coniferous species with the balance made up of softwood deciduous species. This forest resource is believed to support an AAC of approximately 109 million cubic meters.

Allowable Annual Cut

The AAC supported by the total regional forest resource is not clearly identified. However, it would appear to be in the neighbourhood of 109 million cubic meters. The AAC from forests managed by the forest authorities which are accessible and

¹³⁹Group I forests contain 12 million hectares, Group II forests contain 3 million hectares, and Group III forests contain 49 million hectares.

¹⁴⁰There is a total of 17.6 million hectares of the lowest site class category. There are 5 million hectares of stocked forest land which has been allocated to long-term uses. Therefore, there is (17.6 less 5) approximately 13 million hectares assuming that all forest land allocated to long-term uses is in site class 5a and lower.

¹⁴¹There are 20.406 billion cubic meters of accessible or potentially accessible timber in Asian USSR. The AAC in Transition RSFSR is 103 million cubic meters while the AAC in Pacific Asia is 279 million cubic meters. Thus, the share of mature and over-mature wood in Transition RSFSR is $(103/(279+103)*20.406)$ 5.5 billion cubic meters.

potentially accessible amounts to 103 million cubic meters. The AAC from agricultural land is estimated to be 6 million cubic meters.¹⁴² Therefore, the total AAC from accessible and potentially accessible forested land in the forest fund is approximately 109 million cubic meters. An additional 14 million cubic meters could be available from reserve and presently inaccessible forests. Thus, the long-term AAC from the forest resource in the Transition RSFSR region approaches 123 million cubic meters.

Forest Agency AAC

The allowable annual cut of this region has fluctuated in a narrow range since 1980 (Table C30). In 1989, the AAC was 103 million cubic meters. Most of the AAC is composed of softwood deciduous species which account for almost 54 million cubic meters. Coniferous species makes up the remaining 48 percent or 49 million cubic meters. Hardwood deciduous species are not represented. In addition to the AAC in accessible and potentially accessible stands, an AAC of 14 million cubic meters is located in the reserve stands, 9 million of which is coniferous species. Thus, the total AAC in the accessible and potentially accessible forested land and reserve and inaccessible forest land is 1.17 million cubic meters. Coniferous species account for 58 million cubic meters while softwood deciduous species account for 59 million cubic meters.

As shown in Table C29, most of the AAC is located in Group III forests which contain 94 million cubic meters or 91 percent of the region's total. Group II forests contribute 4 million cubic meters while Group I forests contribute 5 million cubic meters.

Future Outlook of the AAC

The AAC from reserve and inaccessible forests may not be realizable in the future because of a host of environmental and economical problems associated with regional development. The AAC which is presently accessible or potentially accessible is probably overstated. While it is difficult to assign an estimate to this, it is believed that the figure of 10 percent derived for the European USSR is undoubtedly appropriate. Thus the AAC in the presently accessible stands probably amounts to not more than 35 million cubic meters. The potential AAC (in the potentially accessible stands) should also be discounted to account for likely environmental and transportational problems. While the overall discount applied to the AAC has been

¹⁴²Vorob'yev, G. I. et alia, *Ekonomicheskaya Geografiya Lesnikh Resursov SSSR*, page 56.

about 10 percent, a reduction of almost 20 percent for the remaining AAC would be more appropriate to account for the more severe environmental conditions connected with the Transition RSFSR region. Thus, the AAC in the potentially accessible forest resource amounts to nearly 55 million cubic meters.

HARVEST

Table C31 showed that since 1940, log removals in the Transition RSFSR region have accounted for an increasing share of the total Soviet wood deliveries. Since 1980, wood removals have risen by nearly 5 million cubic meters. By 1989, the deliveries had reached 9 percent of the Soviet totals or 35 million cubic meters of roundwood. Almost 90 percent of the "official" harvest is believed to originate through the principal utilization from forest resources managed by the forest authorities. In 1989 amounted to 32 million cubic meters. Intermediate utilization is believed to contribute 2 million cubic meters while other utilization is thought to produce nearly 4 million cubic meters. Thus, with the harvest from principal utilization of 32 million cubic meters, the total estimate harvested by forest authority organizations is estimated to be 38 million cubic meters, 3 million cubic meters in excess of the "officially" claimed to be delivered to processing centers within the planned system. While it is uncertain the reason for this discrepancy, it is possible that it is either connected with inefficient data collection, or the "harvested" wood being directed to manufacturing centers not included in the reporting network.

While data is lacking for recent years on the break-down of the harvest into the species group components, information is available for 1982 (shown in Table C44). Coniferous species accounted for 65 percent of the harvest with the remainder accounted for by softwood deciduous species. The coniferous harvest is of interest, particularly since the coniferous component of the AAC contributed only 48 percent of the total. While the AAC is grossly underutilized, the apparent emphasis on the coniferous species cannot be overlooked as the actual harvest favours conifers over deciduous species.

Utilization of AAC

Overall, nearly 30 percent of the allowable annual cut from forests managed by the forest authorities was harvested in 1982. The coniferous component of the AAC was much more utilized than the softwood deciduous component (38 percent versus 19 percent). While species specific information is not available for recent years, the size

and share coniferous and deciduous harvest in 1982 is believed to be applicable to 1989.

The inability of the Soviet industrial structure to use the deciduous species is apparent. Thus, assuming that a disproportional high share of the deciduous resource is not located in the non-accessible forested land, a large part of the softwood deciduous species is already accessible and simply awaiting the right manufacturing process to support increased harvesting.

The harvest figures attributed to the non-forest authority resource are not available. However, it is believed that this AAC component is fully utilized.

REGENERATION

Estimates of regeneration accomplishments on a regional basis are not available. However, most of the fire damage is believed to be located in Pacific Asia. Given the reported balance between harvest and restocking which exists on the national level, the Transitional RSFSR region is estimated to have a reasonable balance between harvesting and reforestation.

PROGNOSIS

While nearly 70 percent of the current regional AAC is unutilized, not all of the potential forest land is readily accessible in the near to medium term. The Soviets consider the AAC to include not only stands which are currently accessible, but those which are expected to become accessible within the next 15 to 20 years. Assuming that the 40 percent utilization rate of the coniferous component of the AAC represents the overall share of the AAC which is economically developed at the present time, harvest could be expected to increase in the softwood deciduous species to at least the 40 percent utilization level if technology and markets are developed. The additional harvest then amounts to 6 million cubic meters of which probably 75 percent of this increase would be birch and 25 percent aspen.

Additional output from intermediate utilization depends on a well developed immature class and local markets which are absent in Transitional RSFSR. The lack of appropriate technology for thinning operations and the high cost of logging and transportation will mitigate against an increase in harvest from intermediate utilization.

Other utilization in the past has generated an estimated 4 million cubic meters annually. Harvest in this utilization category is generally tied to regional industrial development and economic activity. In the near to medium term, as the USSR seeks to implement the process of transition to a market economy, we would expect the harvest to at best stay constant. In the long-term, activity fueled by economic development could lead to substantial increases.

Additional harvest increases beyond the 6 million cubic meters (connected with the increase utilization of the already developed deciduous resource) are dependent in large part on the infusion of foreign capital and technology. Given the central location of this region viz a viz external markets, foreign capital will likely find it not profitable to invest given the alternatives existing in either European USSR or the Pacific Asian USSR. Thus, utilization increases in the near to medium term are expected to be limited to no more than the 6 million cubic meters of deciduous species believed to be already developed.

Beyond this extra volume which is believed to be from forests already developed and accessible, an additional potential AAC of about 55 million cubic meters is "developed" in the sense that it is located within 200 kilometers of major transportation routes.¹⁴³ Additional major investment in infrastructure is needed to make this AAC available for harvest. Estimates by Soviet sources place the capital cost to be between 170 thousand and 220 thousand roubles per cubic meter of AAC developed.

¹⁴³Vorob'ev et alia in "Ekonomicheskaya Geografiya Lesnikh Resursov SSSR" on pages 303 and 304 discuss the impact of the construction of the BAM railway on the accessibility of the forest resource. Forest resource within a distance of between 150 and 200 kilometers from the railway was considered to be within the BAM zone, and therefore to be potentially developable.

CENTRAL ASIA

THE FOREST RESOURCE

Overview

Central Asia contains only 3 percent of the total Soviet land area, 3 percent of the forest land, but only 2 percent (or 17 million hectares) of the stocked forest land. Yet, while accounting for 2 percent of the total stocked land area, Central Asia accounts for 30 percent of all hardwood deciduous species land area in the USSR, or 9.8 million hectares. Not unsurprisingly given the modest forest area, the Central Asian region does not contain significant forest inventory volume and is not a major supplier of roundwood in the USSR. Only 420 million cubic meters of growing stock is supported by 17 million hectares of stocked forest land. Only 3.4 million hectares of forest are considered mature and over-mature which supports 145 million cubic meters of timber inventory. Almost 3 million hectares of stocked forest land are not included in one of the three major specie groups suggesting a greater non industrial use and environmental use of the forests. Tables C27 and C28 show a regional breakdown of the Soviet forest resources.

The role of forests is primarily as a purveyor of non-commercial environmental values. Timber stocking is minimal except in parts of Kazakhstan where volumes exceeding 100 cubic meters per hectare are encountered in coniferous stands. The average volume per hectare in mature and over-mature stands is 43 cubic meters, while in immature stands, the stocking is 24 cubic meters per hectare.

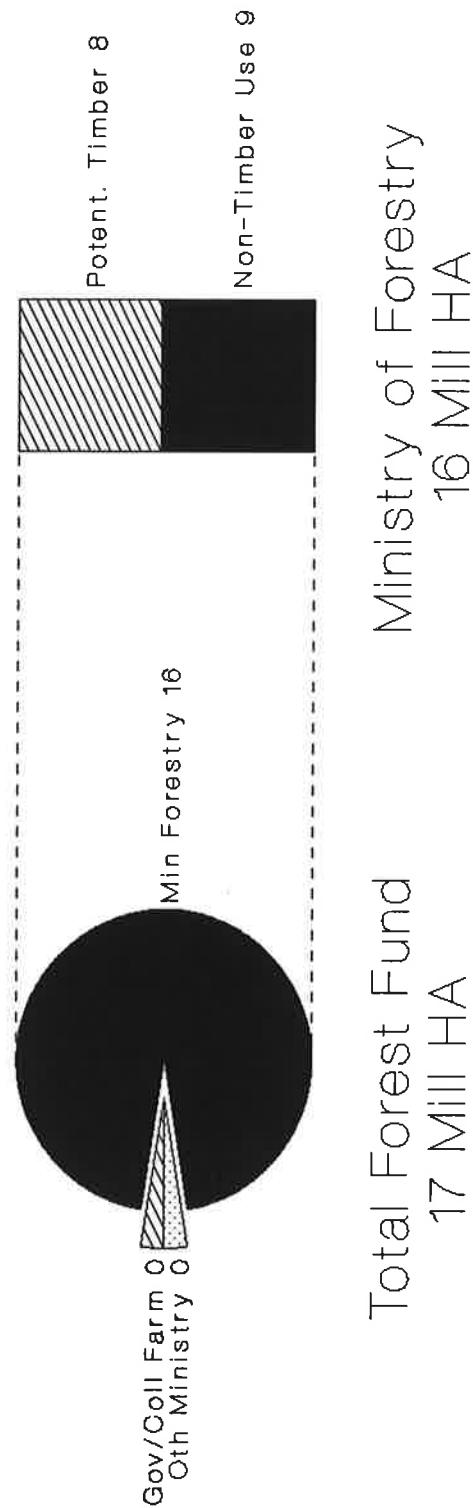
Administrative Responsibilities

Figures 39 and 40 show the forest resources of the Central Asian region contained in the forest fund.¹⁴⁴ Central Asia contains the lowest share of stocked forest land (which has timber producing potential) which is administered by the forest authorities. Only 46 percent of the stocked forest land is managed by either the forest industry or the forestry authorities. More than 50 percent of the forests are allocated to non-timber long-term uses though still administered by the forestry authorities. Collective and government farms contribute a small and insignificant part to the inventory of the forest fund amounting generally to less than one percent of the regional total.

¹⁴⁴Tables C57 and C58 present in greater detail information describing the forest fund of Central Asia.

CENTRAL ASIAN FOREST LANDS BY MAJOR MANAGEMENT ORGANIZATION

Million Hectares

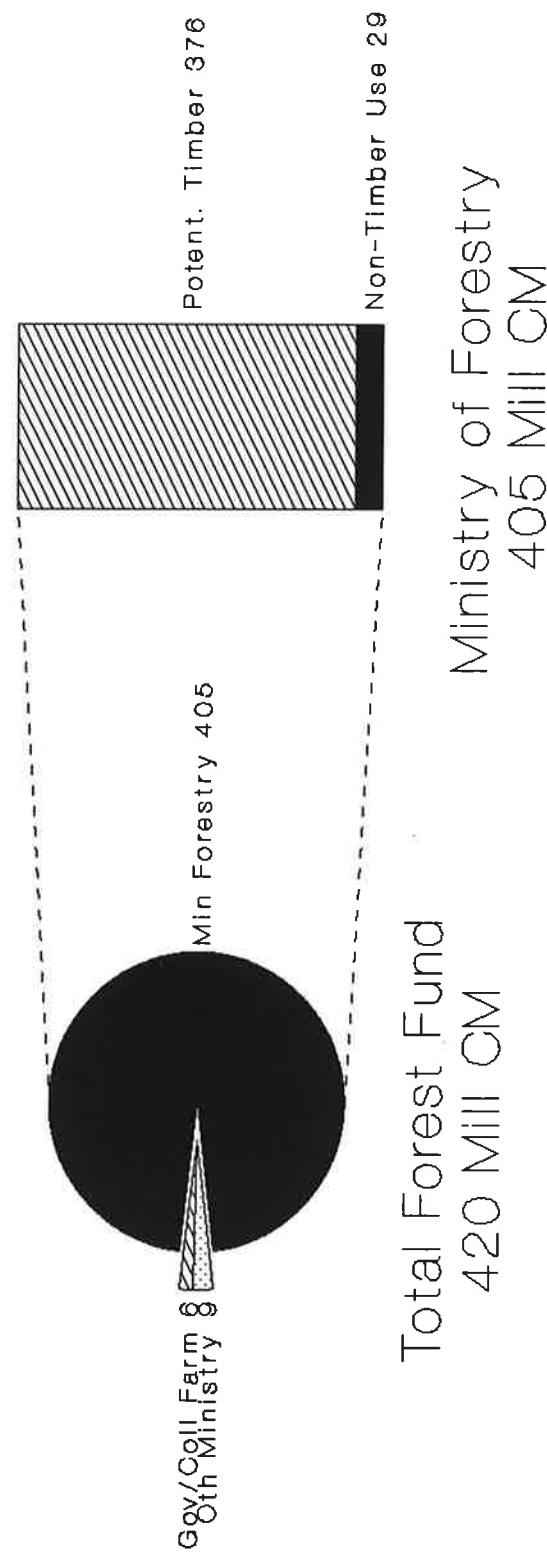


CINTRAFOR/cab/trw

Figure 39

CENTRAL ASIAN USSR FOREST INVENTORY BY MAJOR MANAGEMENT ORGANIZATION

Million Cubic Meters



CINTRAFOR/cab/trw

Figure 40

Forests allocated to non-timber long-term uses amount to 8.5 million hectare, of which hardwood deciduous species are located on 7.2 million hectares or almost 85 percent. Nearly all of the remaining 1.3 million hectares in this category contain species other than those of the three principal species groups. Growing stock is minimal yielding about 25 cubic meters per hectare.

Forests not allocated to long-term uses, on the other hand, contain a more balanced distribution of stocked forest land among the three species groups. While hardwood deciduous species account for the largest share, softwood deciduous species represent 17 percent, coniferous species represent 27 percent and other species represent 22 percent. More than two thirds of the volume of 376 million cubic meters of growing stock is coniferous species. Stocking in the mature and over-mature stands is 106 cubic meters per hectare. In the immature stands - 48 cubic meters per hectare.

Land Under Control of the Forest Authorities

Slightly over 7.8 million hectares of stocked forest land, supporting 376 million cubic meters of growing stock, is managed by the forest authorities.¹⁴⁵ Nearly 1.2 million hectares with 132 million cubic meters are considered mature and over-mature. Forest resources managed directly by the forest industry are nonexistent.

The stocking in the mature and over-mature age classes of timber lands is quite high, amounting to 148 cubic meters per hectare. Stocking in immature age classes averages nearly 100 cubic meters per hectare. Although the stocking is less than in European USSR, it is higher than the minimum stocking levels believed to support economical harvesting activity. As mentioned before, this economic stocking level is 140 cubic meters per hectare.

Primary Use to which the Forest is Placed - Forest Groups

Figure 41 shows that of the 12 million hectares of forest land in the forest fund, nearly 8 million hectares (or 63 percent) is considered stocked. More than 4 million hectares (or 34 percent) of the land is thought to be unstocked. Immature plantations,

¹⁴⁵The forests allocated to long-term use are under the administration of the forestry authorities, but have no industrial significance. These forests are excluded from the following discussion about the forest resource of the Central Asian region, re-emerging only for the sections dealing with site and stocking class.

CENTRAL ASIA FOREST LAND UNDER FOREST ADMINISTRATION BY STOCKING

Ministry of Forestry and Forest Industry

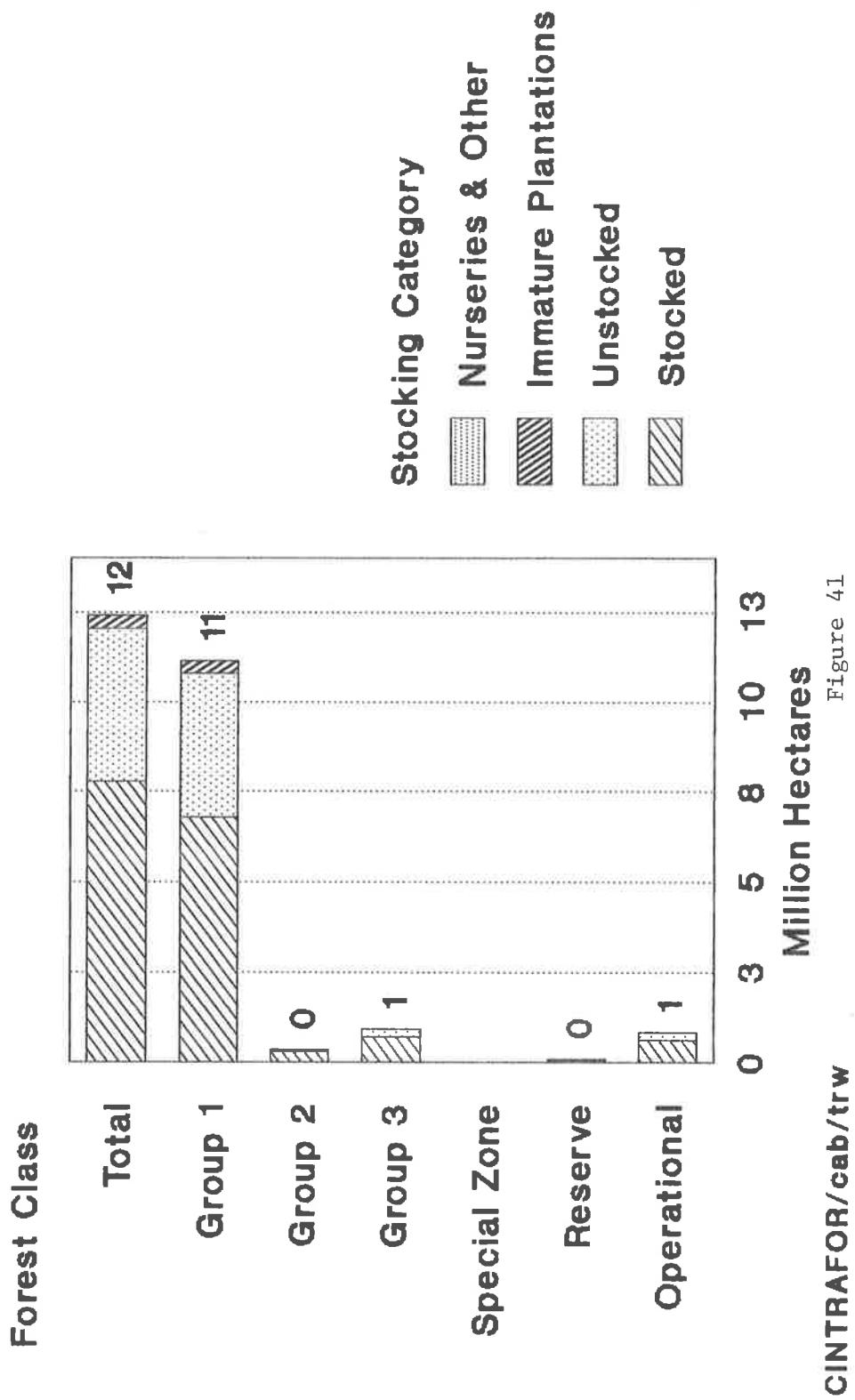


Figure 41

CINTRAFOR/cab/trw

nurseries, and other unspecified categories of forest land do not contribute significantly to the forest fund. **Figure 42** presents the distribution of the unstocked forest land among the different categories. Nearly two and one-half million hectares of unstocked forest land are due to glades or small openings in the forest canopy. Another one and one-half million hectares have been classified as unstocked due to large openings and general barren land. Burned forest land and cutover land, both yet to support another crop of trees, do not contribute significantly to the unstocked forest land of Central Asia.

As Table C59 shows, nearly 90 percent of the 8 million hectares of stocked forest land is contained in Group I forests. Group II forests contain 4 percent and Group III forests contain 9 percent of the stocked forest land. Nearly 4 million hectares are unstocked. Table C60 shows that more than 90 percent of the unstocked forest land are considered glades in the forest or extended areas of open unstocked land. While inventory volume information is unavailable for each group of forest, it is expected that most of the growing stock is concentrated in Group III forests despite the low share of stocked forest land. Information from an inventory of the early 1970's shows that Group III forests account for more than 50 percent of the mature and over-mature volume, while Group I forests accounted for 40 percent and Group II forests 10 percent.¹⁴⁶

Species

As **Figures 10 and 11** showed, the principal species group in Central Asia is hardwood deciduous species which accounts for nearly 70 percent of the total stocked forest area. Coniferous species account for only 18 percent of the stocked forested land. Softwood deciduous species represent only 10 percent.^{147, 148} While contributing nearly 18 percent of the stocked forest land, coniferous species account for over 60 percent of the volume. Hardwood deciduous species, in contrast, while accounting for 70 percent of the stocked forest land, contain only 7 percent of the growing stock. Softwood deciduous species contain 30 percent of the growing stock.

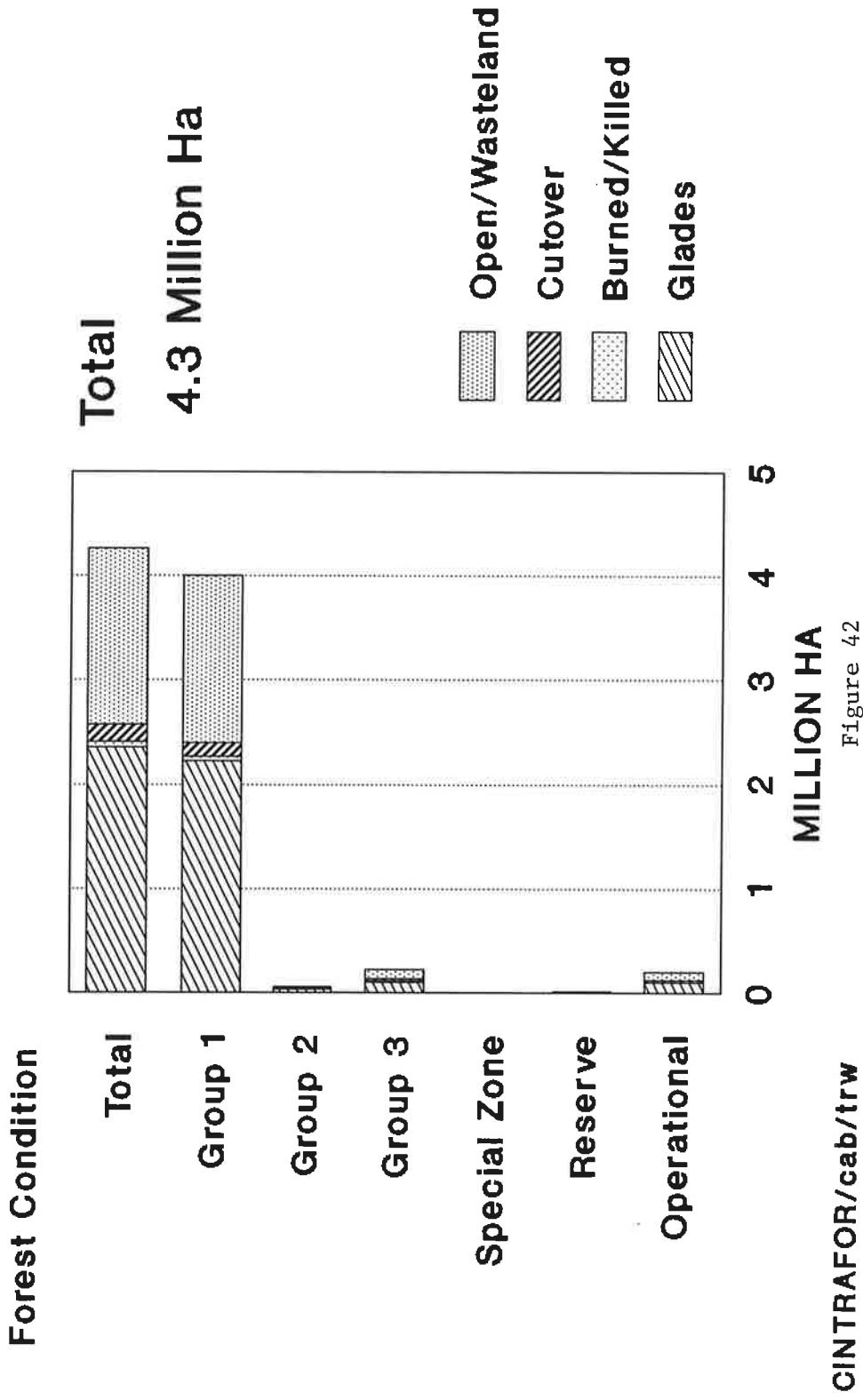
¹⁴⁶Barr, Brenton and Braden, Kathleen, *The Disappearing Russian Forest*, page 51

¹⁴⁷**Figures 10 and 11** are based on detailed information presented in Tables C33 and C34.

¹⁴⁸The detailed information concerning species distribution used for the description of the USSR and the European USSR is not available for Central Asia. The basis for this section includes all stocked forest land and Growing stock allocated to management by the forest authorities (including forests allocated to long-term uses). The forest resource not specifically included in with any of the three species groups is excluded.

CENTRAL ASIAN UNSTOCKED FOREST UNDER FOREST ADMINISTRATION BY CONDITION

Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 42

Pine constitutes the largest share of coniferous species occupying 7 percent of the forested land and 24 percent of the growing stock under coniferous species. The remaining 11 percent of stocked forest land and growing stock is accounted for by spruce, true firs, larch and other unidentified species characteristic of desert types of environments. Most of the softwood deciduous species group area is accounted for by birch and aspen which contribute 7 percent and 2 percent respectively of the stocked forest land. Most of the hardwood deciduous species are accounted for by those frequently encountered tree species in desert environments such as saksaul.

Site Class

Figure 43 shows the distribution of stocked forest land by site class.^{149, 150} While Central Asia does not contain a large area of stocked forest land, most of the 13.5 million hectares is located in site class 3 and site class 2 and higher. These two site class categories occupy slightly over 80 percent of the area. The lowest site class category, 5a and lower occupy only one percent of the stocked forest land.

Coniferous species, while accounting for only 18 percent of the stocked forest land, represent between 40 percent and 65 percent of the three lowest site classes. Hardwood deciduous species dominate the highest two site classes where they account for more than 80 percent of the stocked forest land in these site classes. More than 90 percent of hardwood deciduous species are located in these two site classes.

Stocking Class

Figure 44 shows the distribution of stocked forest land by stocking class.^{151, 152} Not surprisingly, given the heavy environmental protection orientation of forests in Central Asia, nearly 70 percent of the stocked forest land is considered to have poor

¹⁴⁹Table C61 shows in greater detail the distribution of stocked forest land among different site classes.

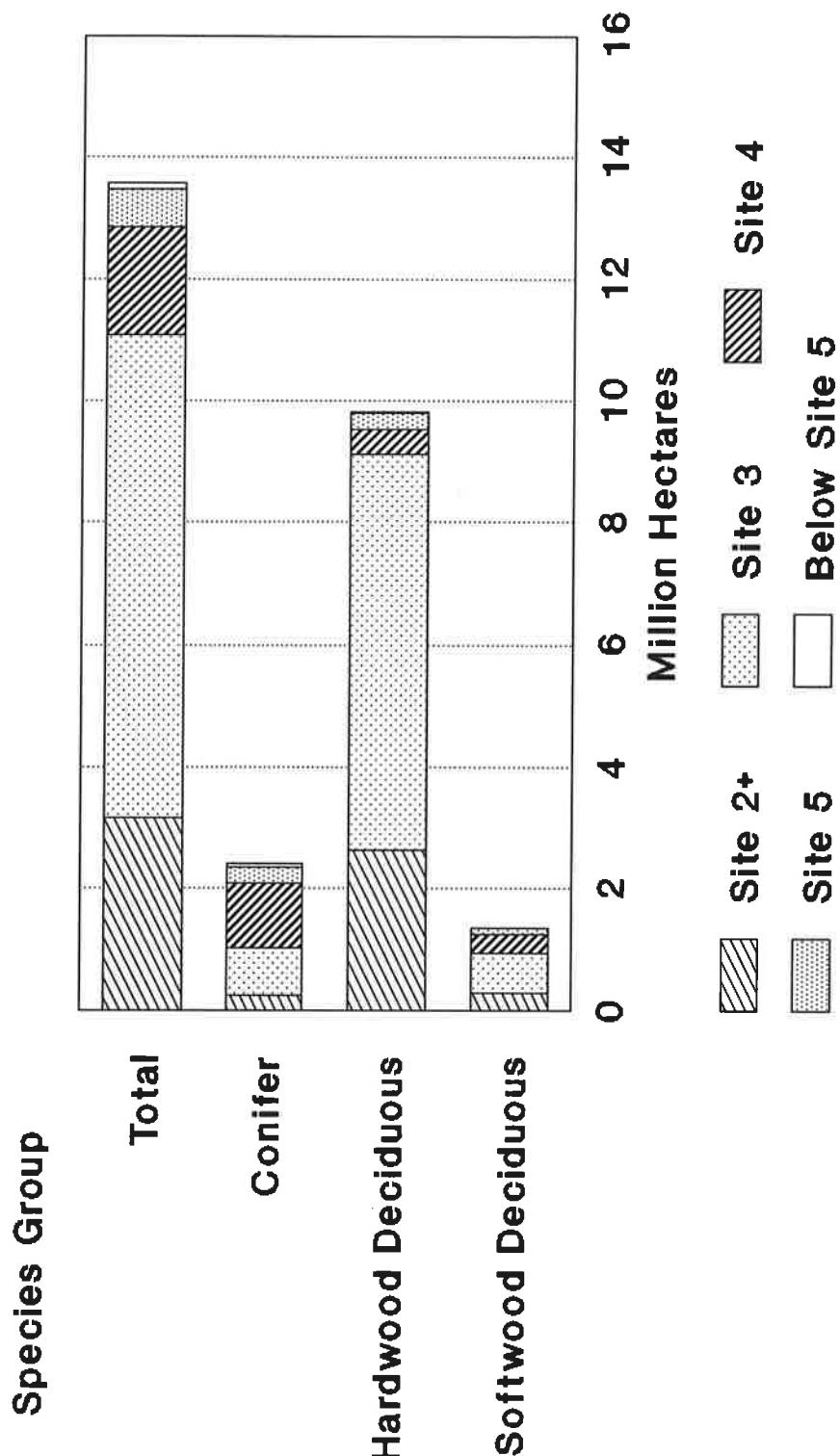
¹⁵⁰Site class information is restricted to 14 million hectares containing the principal species located on the combined stocked forest land contained on Groups I, II, and III forests plus forests allocated for non-timber long-term uses. These forests are administered by *Goskomles*.

¹⁵¹Table C62 presents a more detailed picture of the distribution of stocked forest land among the three stocking classes.

¹⁵²Stocking class information is restricted to 14 million hectares containing the principal species located on the combined stocked forest land contained on Groups I, II, and III forests plus forests allocated for long-term uses other than the production of timber. These forests are administered by *Goskomles*.

CENTRAL ASIA STOCKED FOREST LANDS UNDER FOREST ADMINISTRATION BY SPECIES & SITE

Ministry of Forestry and Forest Industry

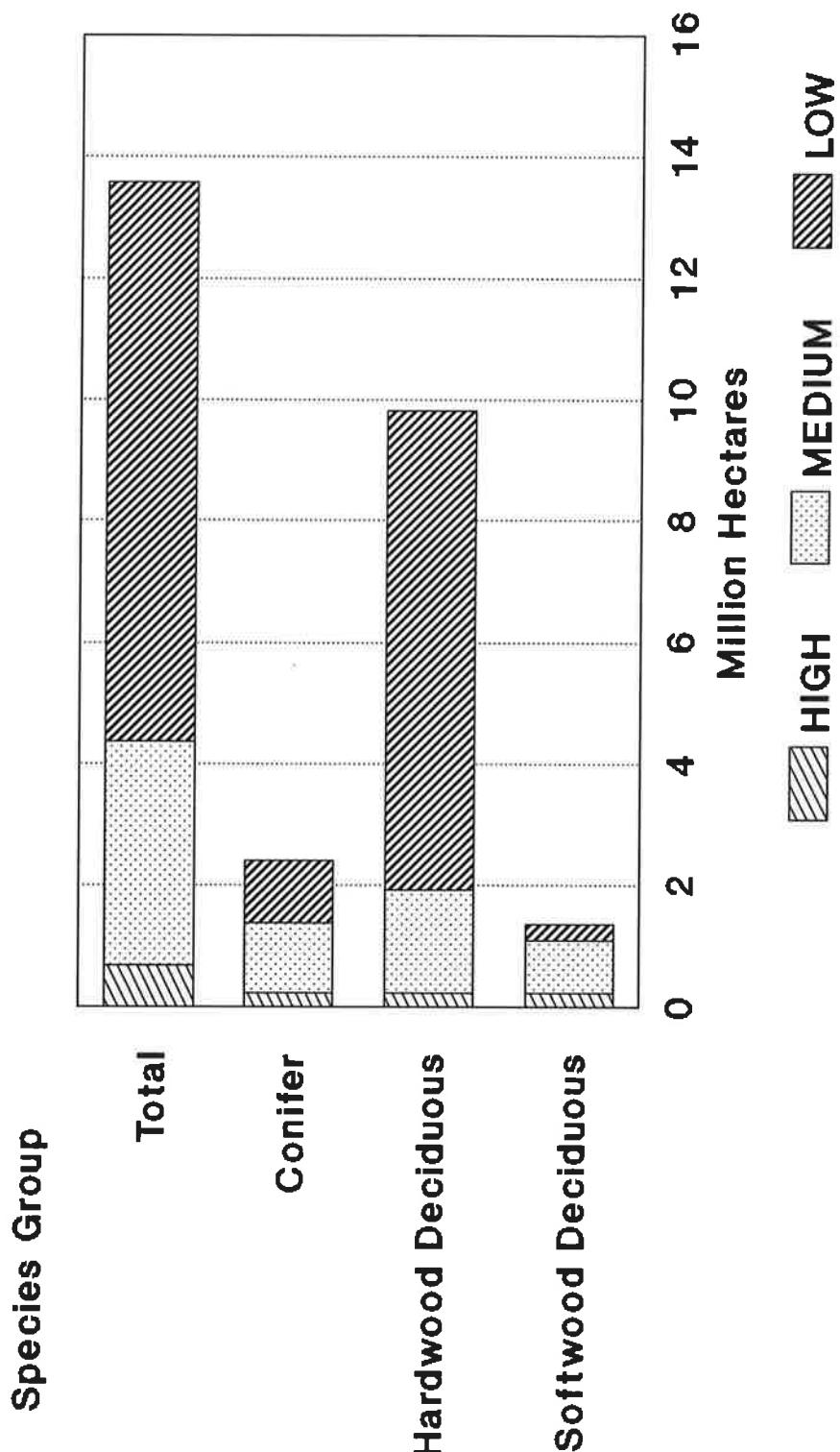


CINTRAFOR/cab/trw

Figure 43

CENTRAL ASIA REGION STOCKED FOREST LANDS UNDER FOREST ADMIN BY SPECIES & STOCKING

Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 44

stocking. Only 32 percent of the forests are thought to have either medium or good stocking. While softwood deciduous and coniferous species occupy a more balanced distribution of stocked forest land among the three stocking classes, nearly four fifths of the hardwood deciduous forested land account for 90 percent of the poor stocking class.

Age Class

A detailed break-down of the inventory into age classes is also not available for Central Asia.¹⁵³ However, information is available on a mature-overmature and immature classes which is presented in Tables 65 and 66. Only 20 percent of the stocked forest land and 36 percent of the growing stock is considered mature and over-mature.

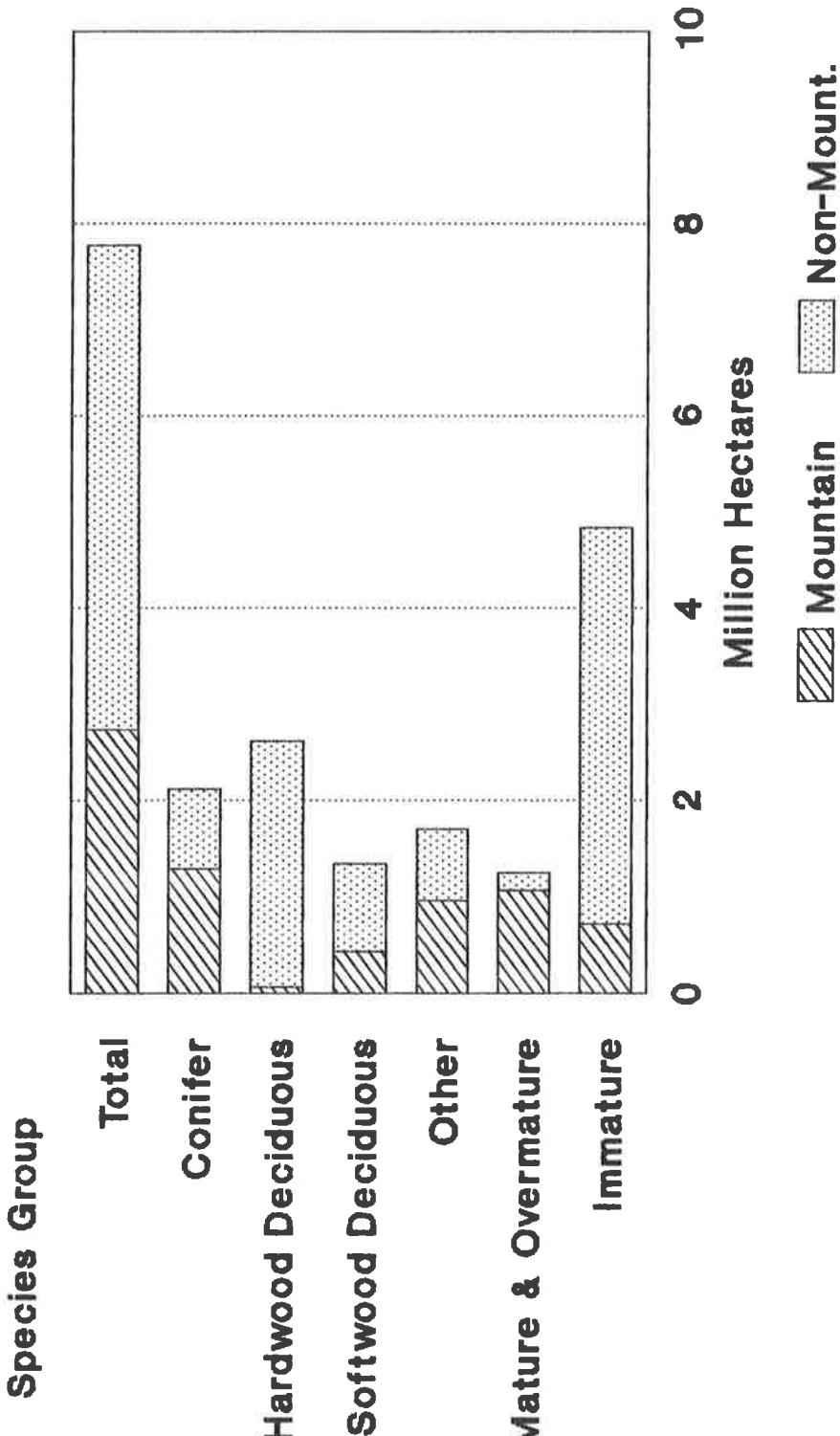
Figure 45 shows that coniferous species occupying only 750 thousand hectares of the 3.3 million hectares of stocked forest land in the mature and over-mature age classes. Yet conifers account for more than 100 million cubic meters of the 145 million cubic meters of mature and over-mature timber. Hardwood deciduous species account for 2.3 million hectares of the mature and over-mature area but only 7 million cubic meters. Softwood deciduous species contain only 307 thousand hectares which support 34 million cubic meters.

Mountain Forests

The Central Asian forest resource in mountain forest is shown in Tables 63 and 64. Of the 2.7 million hectares of stocked forest land and 197 million cubic meters of growing stock, 64 percent and 49 percent respectively are located in Group I forests. While containing 25 percent of the forested land, Group III forests contain nearly 40 percent of the growing stock. Group II forests account for 11 percent of the stocked forest land and 13 percent of the growing stock. Almost 50 percent of the stocked forest land and nearly 80 percent of the growing stock consist of coniferous species. While accounting for an insignificant share of the growing stock, brush and other non principal species forest resource account for approximately 30 percent of the forested land.

¹⁵³Since information about the age class distribution of the forest resource is not available, the general division between immature and mature and over-mature available from data about the forest fund in Central Asia has been used here.

**CENTRAL ASIA REGION STOCKED FOREST LAND
FOREST ADMINISTRATION BY SPECIES GROUP**
Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 45

As shown in **Figure 45**, mountain forests in Central Asia account for 35 percent of the stocked forest land under management by the forestry authorities.¹⁵⁴ While mountain forests account for only 35 percent of the forested land, more than 50 percent of the growing stock is located here. Mountain forests account for the lowest share of Group I forests amounting to 26 percent. In Groups II and III, mountain forests account for all the stocked forest land. Almost half of the hardwood deciduous species grow in mountain forests as compared with 9 percent of coniferous and 14 percent of softwood deciduous forests.

Accessibility

The forest resources of Central Asia managed by the forest authorities for non long-term uses are not large amounting to only 6 million hectares and 363 million cubic meters of growing stock. Only 1.2 million hectares and 132 million cubic meters of growing stock are considered mature or over-mature. Coniferous species (accounting for 55 percent of the forested land and 41 percent of the growing stock) and softwood deciduous species (accounting for 22 percent of the stocked forest land and 24 percent of the growing stock) support a volume per hectare which would be considered close to economic levels. Coniferous species have a stocking of 149 cubic meters per hectare in mature and over-mature age classes and 95 cubic meters per hectare in immature stands while softwood deciduous species have 119 cubic meters per hectare and 79 cubic meters per hectare respectively. Hardwood deciduous species are not suitable for industrial activity due to low stocking levels.

Forest resources in reserve and presently inaccessible forests, shown in **Figure 18**, amount to only 47 million cubic meters of growing stock. Coniferous species account for 40 million cubic meters and softwood deciduous species account for 6 million cubic meters. The AAC supported by the reserve forests is not clearly identified, but would appear to be inconsequential.

The accessible and potentially accessible mature and over-mature growing stock, shown in **Figure 19**, support an AAC of 3.2 million cubic meters, most of which is located in Kazakhstan. The forest resource available from non-forest authorities is

¹⁵⁴Tables C65 and C66 show in greater detail the distribution of stocked forest land and growing stock between mountain and non-mountain forest.

not large and is not thought to support significant AAC. Thus only the AAC presently available from forest authorities is believed to support industrial activity.

Allowable Annual Cut

The total AAC in Central Asia is not large, but is believed to lie closely to that derived from the forest resource managed by *Goskomles*. This AAC is approximately 3.2 million cubic meters. Since the AAC from the inaccessible and reserve forest resource is not considered important, the long-term AAC is believed to approximate 3.2 million cubic meters available from the forests administered by the forest authorities.

Forest Agency AAC

Table C30 shows that the AAC in Central Asia is not large, amounting to about 3 million cubic meters. This is consistent with the small scale of the forest resource. More than half of the AAC is located in coniferous species. Softwood deciduous species provide an AAC of 1.25 million cubic meters and hardwood deciduous species provide an AAC of 270 thousand cubic meters. Two-fifths of the AAC is located in each of Group I and Group III forests. One fifth is located in Group II forests.

Future Outlook for the AAC

Since 1980, the Central Asian AAC has not fluctuated more than 50 thousand cubic meters. Available data suggests that there will not be significant changes in the near to medium term.

HARVEST

Most timber harvesting is concentrated in Kazakhstan which has produced nearly all of the wood cut in Central Asia. In 1989, the "official" cut was 2.5 million cubic meters. Harvest from the primary utilization has fluctuated since 1980 between 1.7 million and 1.9 million cubic meters. In 1989, 1.8 million cubic meters were harvested. Approximately 700 thousand cubic meters have been harvested through intermediate utilization, an increase of 100 thousand cubic meters since 1980. Almost 360 thousand cubic meters of wood was harvested under other utilization in 1989, a substantial increase over 1980 when only 90 thousand cubic meters were harvested.

Since 1980, the share of harvest accounted for by coniferous species has not fluctuated widely around 50 percent. Hardwood deciduous species have contributed

nearly 5 percent while softwood deciduous species account for 45 percent of the harvest.

Utilization of the AAC

The AAC in each of the three species groups are utilized to nearly the same degree. Approximately one half of the AAC in both coniferous species and hardwood deciduous species have been utilized while nearly two-thirds of the softwood deciduous AAC has been utilized.

REGENERATION

Regeneration accomplishments on a regional basis are not available. However, most of the fire damage is believed to be located in Pacific Asia. Thus, we expect that given the balance between harvest and restocking which exists on the national level, that Central Asia is also balanced. In fact, substantial additions to the forest land base may be occurring in response to attempts to reduce the incidence of soil erosion by wind and encroachment of desert upon developed parts of this region.

PROGNOSIS

The largest share of the present Central Asian AAC harvested occurs in the softwood deciduous species where in 1989 two-thirds of the AAC were utilized. If this same ratio of utilization could be achieved in the coniferous AAC and hardwood deciduous AAC, an additional harvest of 240 thousand cubic meters of coniferous species and 30 thousand cubic meters of hardwood deciduous species would be possible.¹⁵⁵

Additional harvest from intermediate utilization is not expected to occur in the near to medium term. The increase in the harvest in the recent past has amounted to only 100 thousand cubic meters. Improved thinning technology and incentives may not spread rapidly to the Central Asian region. While the harvest from other utilization has increased four fold since 1980, the likely increase for the next 10 year period should be more muted amounting to no more than 300 thousand cubic meters. Thus, the potential increase in Central Asian harvest over the near to medium term is expected to be no more than 570 thousand cubic meters.

¹⁵⁵The assumption here is that the proportion of the softwood deciduous AAC utilized represents the share of the AAC within each species group which is presently accessible. The remaining share stands for the AAC which is expected to be accessible within the next 15 to 20 years.

Central Asia has been a net importer of industrial wood. Imports amounted to nearly 5 million cubic meters in 1989, down slightly from 6 million cubic meters in 1985. The decrease of one million cubic meters is much more than the increase in harvest which occurred over the same time period. Harvest increased by only 400 thousand cubic meters between 1985 and 1989. With an upper limit of 600 thousand cubic meters in the rise of harvest, Central Asia will continue to be a wood deficit region requiring large imports from the surplus regions to support current and future consumption levels. Consumption can be expected to rise as the USSR in general and Central Asia in particular shift towards a market oriented economy.

PACIFIC ASIAN USSR

THE FOREST RESOURCE

Overview

The largest share of the forest fund is located in the Pacific Asian USSR. This region accounts for 66 percent of the total land area, 65 percent of the forest land, and 63 percent of the stocked forest land. It also includes nearly 80 percent of the unstocked forest land. While containing 515 million hectares (or 63 percent) of the stocked forest land, the Pacific Asian region accounts for slightly over 68 percent of the mature and over-mature forest stands. Pacific Asia contains 51 billion cubic meters or 62 percent of the national total. Almost 32 billion cubic meters of mature and over-mature wood, 66 percent of the national totals is located on 241 million hectares of stocked forest land. However, while 66 percent of the nation's mature and over-mature timber is located in this region, only 15 billion cubic meters of growing stock can be considered to be currently or potentially accessible for timber use. This represents 53 percent of all mature and over-mature timber currently and potentially accessible. The average stocking, regardless of accessibility, is 132 cubic meters per hectare in the mature and over-mature stands and 82 cubic meters per hectare in the immature stands. Tables C27 and C28 show a regional breakdown of the forest resources of the Soviet Union.

Administrative Responsibility

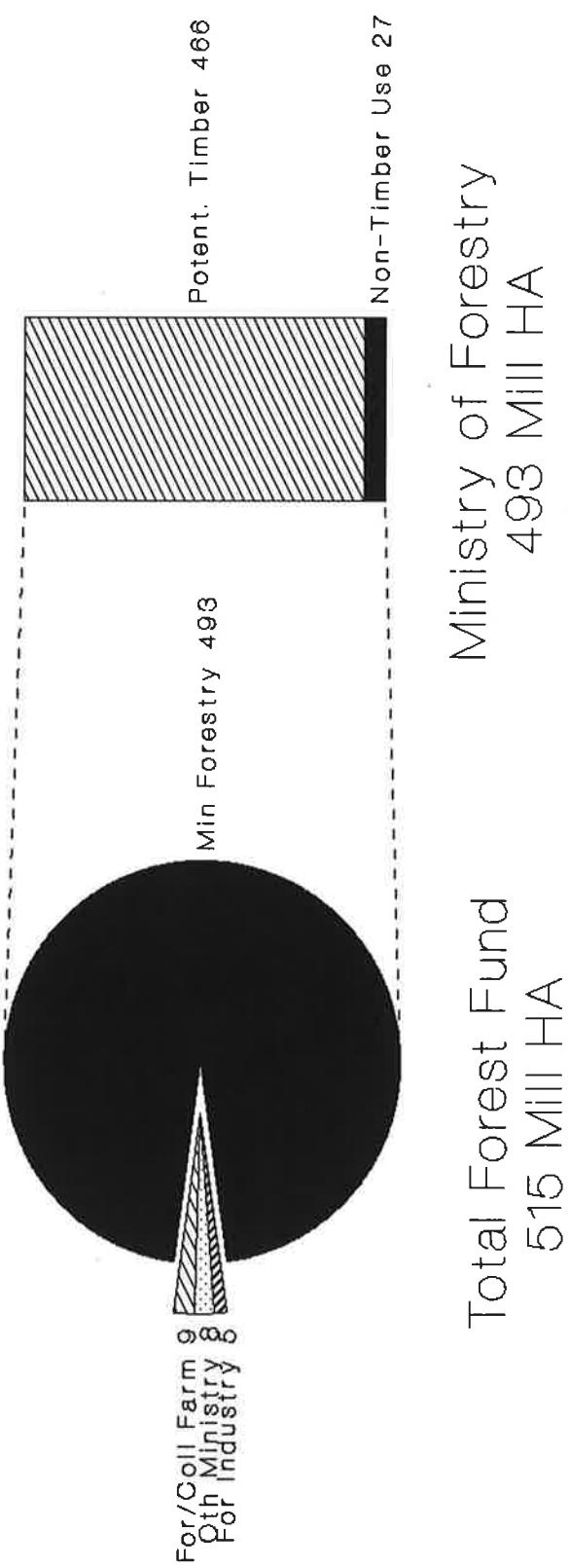
Figures 46 and 47 show the distribution of area and volume among the different management authorities.¹⁵⁶ The share of forests under management by the forest authorities is the highest in the Pacific Asian Region where nearly 471 million hectares (or 90 percent of the forested land) fall under this category of management. Farm forests, collectively, represent only 2 percent of the stocked forest land, the least share of the four regions.¹⁵⁷ The balance is primarily accounted for by forest land allocated for non-timber long-term uses but still administered by the forest authorities. Nearly 27 million hectares of stocked forest land have been allocated to long-term uses.

¹⁵⁶Tables C67 and C68 show in greater detail the distribution of stocked forest land among the different agencies with administrative responsibilities.

¹⁵⁷The Pacific Asian region was the last region to experience development under the western expanding government of the Czarist administration. Coupled with the unfavourable climate, it is not surprising to see a smaller share of forest land which has been alienated to the agricultural sector.

PACIFIC ASIAN FOREST LANDS BY MAJOR MANAGEMENT ORGANIZATION

Million Hectares

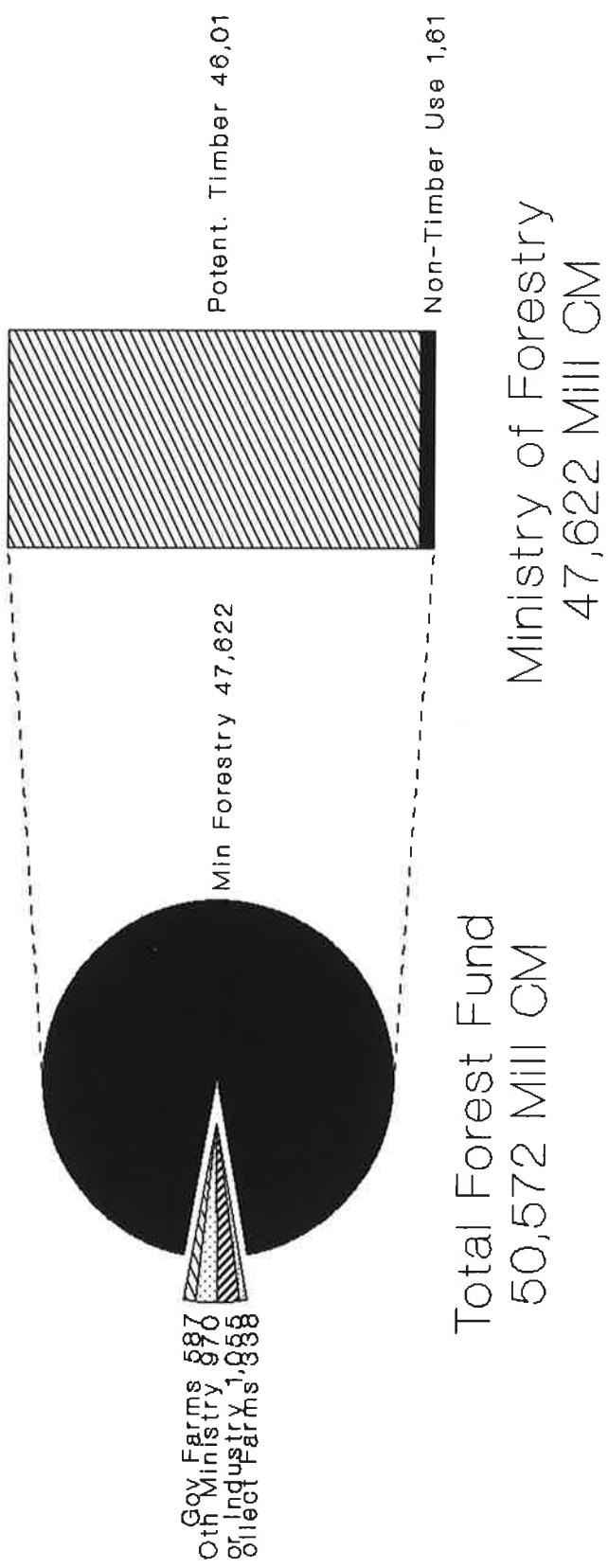


CINTRAFOR/cab/trw

Figure 46

PACIFIC ASIAN USSR FOREST INVENTORY BY MAJOR MANAGEMENT ORGANIZATION

Million Cubic Meters



CINTRAFOR/cab/trw

Figure 47

Coniferous species are primarily located in Pacific Asian region, which contains 379.9 million or 71 percent of the national total of 538.7 million hectares. At the same time, it contains only 11.6 million hectares of hardwood deciduous species and 46.6 million hectares of softwood deciduous species which represent, respectively, 36 percent of the hardwood deciduous and 41 percent of the softwood deciduous species area for the Soviet Union.

Nearly 51 billion cubic meters of growing stock are found in this region. Over 90 percent (or 47 billion cubic meters) is under the administration of the forest authorities. Forests allocated to non-timber long-term uses while accounting for 5 percent of the stocked forest land contain only 3 percent of the growing stock.

The distribution of growing stock follows closely that of the forest land. This region accounts for the largest share of coniferous volume, 42.5 billion cubic meters or 68 percent of the nation's total. While containing significant amounts of hardwood (one billion cubic meters) and softwood deciduous species (3.8 billion cubic meters), the deciduous species represent only 39 and 32 percent of national growing stock volumes respectively. Deciduous species are less prevalent in the Pacific Asian region.

While 56 percent and 59 percent of the coniferous and hardwood deciduous species are in the mature and over-mature age classes, only 30 percent of the softwood deciduous species are located there. Twenty-nine billion cubic meters of coniferous mature and over-mature wood are located on 218 million hectares. The hardwood deciduous specie group, accounting for a small share of the forest resource contains only 745 million cubic meters on 7.7 million hectares of stocked forest land. Over 2 billion cubic meters of mature and over-mature growing stock of softwood deciduous species are located on nearly 16 million hectares of forest land.

Land Under Control of the Forest Authorities

Nearly 471 million hectares with 47 billion cubic meters (or 91 and 93 percent of the stocked forest land and growing stock) are located under the administration of the forest authorities, excluding land allocated to non-timber long-term uses. Nearly 80 percent of the stocked forest land and almost 90 percent of the growing stock are located in coniferous species. Hardwood species account for less than 3 percent of the forest resource. The balance of 20 percent of the forested land and 10 percent of the

growing stock is concentrated in softwood deciduous species. Softwood deciduous species account for 10 percent of the stocked forest land and 8 percent of the growing stock. Other non-principal species, while containing the remaining 10 percent of the forested land, account for only 2 percent of the growing stock. More than 90 percent of the forested land and growing stock in the mature and over-mature age category consists of coniferous species.

Use for which the Land is Intended - Forest Groups

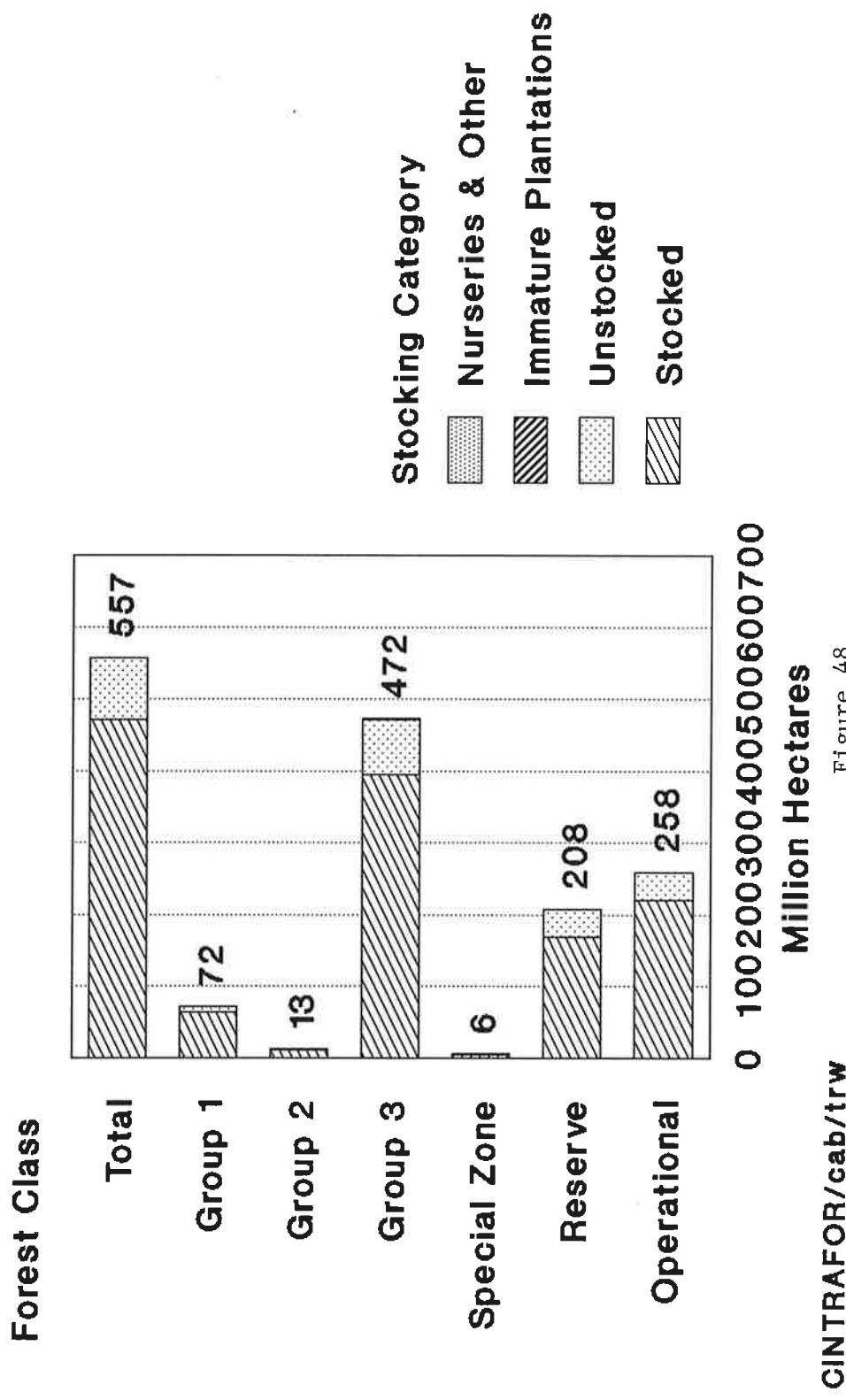
As shown in **Figure 48**, nearly 471 million hectares, or 84 percent of the 557 million hectares of forest land are considered stocked. Fully 15 percent (or 86 million hectares) are viewed as being unstocked. Other categories of forest land contribute an insignificant amount to the forest land base. **Figure 49** presents the distribution of unstocked forest land among the four categories. More than 60 percent of the unstocked total, or 53 million hectares, are attributed to glades or small openings in the canopy. Another 30 percent or 25 million hectares are considered unstocked because of fire damage. Minor amounts (though still amounting to 4 million hectares and 3 million hectares respectively) are unstocked because of harvesting, and large open and barren areas in the forest cover.

As shown in Table 69, nearly 394 million hectares or 85 percent of the stocked forest land in Pacific Asia are contained in Group III forests. Group I forests contain 14 percent while Group II forests contain 3 percent of the stocked forest land. Unstocked forest land accounts for 15 percent of the total forest land. While unstocked forest land in Group II and Group III forests account for between 11 percent and 16 percent of the forested land, not unexpectedly, in Group II forests only 5 percent of the forest land is unstocked. Group III forests contain a large share of reserve forests which account for more than 40 percent of the stocked forest land in total in Pacific Asia and more than 90 percent of all reserve forests in the Soviet Union.

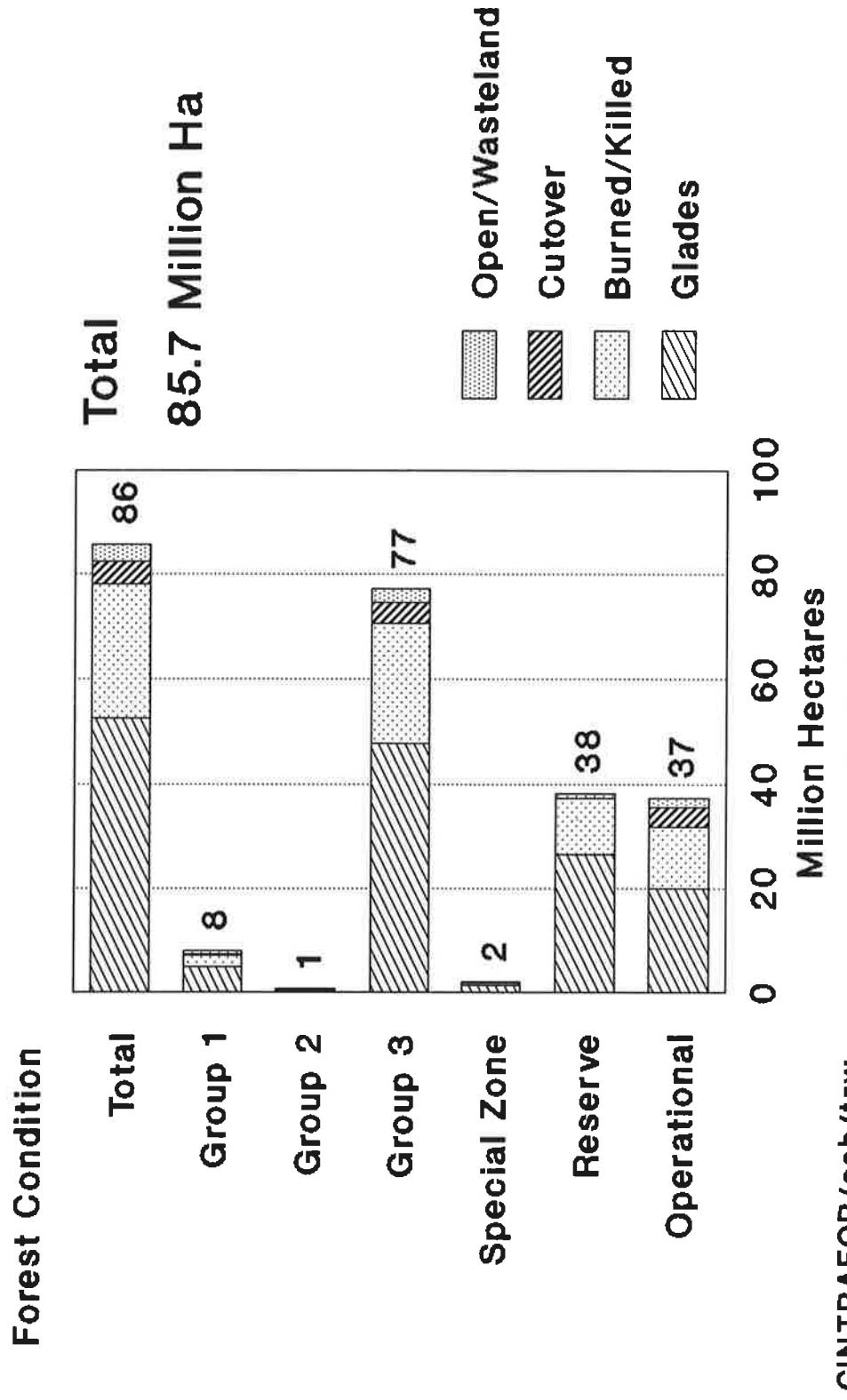
Not unsurprisingly (Table C70), glades and small openings account for the majority of the unstocked forest land in Group I and Group III forests. Group III forests account for 90 percent of the unstocked forest land arising from harvesting activities. However, this category of unstocked forest land accounts for only 5 percent of the unstocked forest land in Group III forests.

PACIFIC ASIA FOREST LAND UNDER FOREST ADMINISTRATION BY STOCKING

Ministry of Forestry and Forest Industry



**PACIFIC ASIAN REGION UNSTOCKED FOREST
UNDER FOREST ADMINISTRATION BY CONDITION**
Ministry of Forestry and Forest Industry



Detailed information concerning the distribution of growing stock among the three groups of forests is unavailable. It is believed that most of the growing stock is located in Group III forests. The largest share of growing stock is undoubtedly coniferous species, a higher share of which would be expected in Group III forests than in any of the other two groups.

Species

As **Figures 10 and 11** showed, coniferous species dominate the inventory of Pacific Asia accounting for 438 million hectares and 47 billion cubic meters (or almost 90 percent of the stocked forest land and growing stock).^{158, 159} The principal species is larch which occupies 62 percent of the forested land and 53 percent of the growing stock. Pine and spruce account for 10 percent and 6 percent of the forested land and 14 percent and 9 percent of the growing stock respectively. Hardwood deciduous species comprise a nominal amount of the regions inventory amounting to just 3 percent of the stocked forest land and 2 percent of the growing stock. Softwood deciduous species amount to 11 percent of the stocked forest land and 8 percent of the growing stock. Birch accounts for the largest share, more than 9 percent of the forested land and 6 percent of the growing stock.

Site Class

While accounting for 63 percent of the stocked forest land of the USSR, Pacific Asia accounts for only 3 percent of the highest site classes. As shown in **Figure 50**, most of the stocked forest land of the Pacific Asian region is located in site classes 3 through 5.^{160, 161} Site class 5a and lower contains nearly 15 percent of the stocked forest land or 60 million hectares, almost 65 percent of all low class forest land in the USSR. While containing only 3 percent of the stocked forest land,

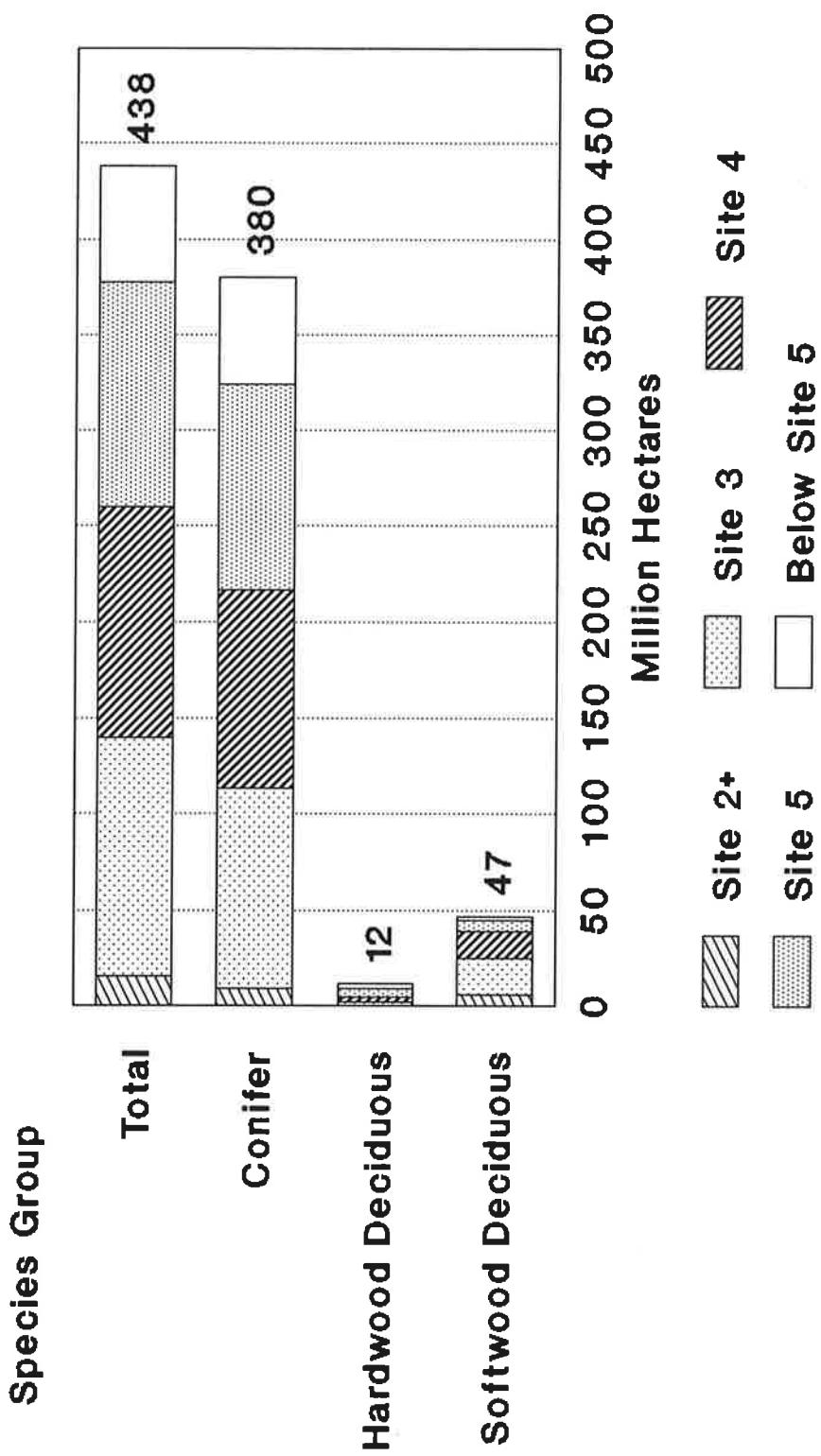
¹⁵⁸Detailed data connected with **Figures 10 and 11** is presented in Tables C33 and C34.

¹⁵⁹The detailed information concerning species distribution used for the description of the USSR and the European USSR is not available for Pacific Asia. The land resource for this section includes all stocked forest land and growing stock allocated to management by the forest authorities (including forests allocated to long-term uses). The forest resource not specifically included in with any of the three species groups is excluded.

¹⁶⁰**Figure 50** presents data based on Table C71.

¹⁶¹Site class information is restricted to 438 million hectares containing the principal species located on the combined stocked forest land contained on Groups I, II, and III forests plus forests allocated for long-term uses other than the production of timber. These forests are administered by either *Goskomles* or directly by the forest industry.

**PACIFIC ASIA STOCKED FOREST LANDS UNDER
FOREST ADMINISTRATION BY SPECIES & SITE**
Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 50

softwood deciduous species account for 40 percent of the highest site class land, with nearly 80 percent of all softwood deciduous land in site classes higher than or equal to site class 4. Coniferous species and hardwood deciduous species on the other hand are primarily concentrated in the lower site classes. Site classes four and below account for 70 percent of the coniferous species and 85 percent of the hardwood deciduous species.

Stocking Class

As shown in **Figure 51**, nearly one-third of the stocked forest land contain stands which are classified as having the poorest stocking class.^{162, 163} Nearly 60 percent are believed to have medium stocking while only 11 percent are considered to have good stocking. As with the other regions, a disproportionately larger share of coniferous species are located in the poorest stocking classes. The large share in the poor stocking classes is connected to both the large incidence of below average site classes and general inhospitable climate throughout much of the Pacific Asian region.

Age Classes

While detailed information concerning the distribution of the forest resource into the four immature age classes is not available, it is possible to develop an appreciation for the age structure of the Pacific Asian resource by considering the division between mature-overmature and immature age classes.

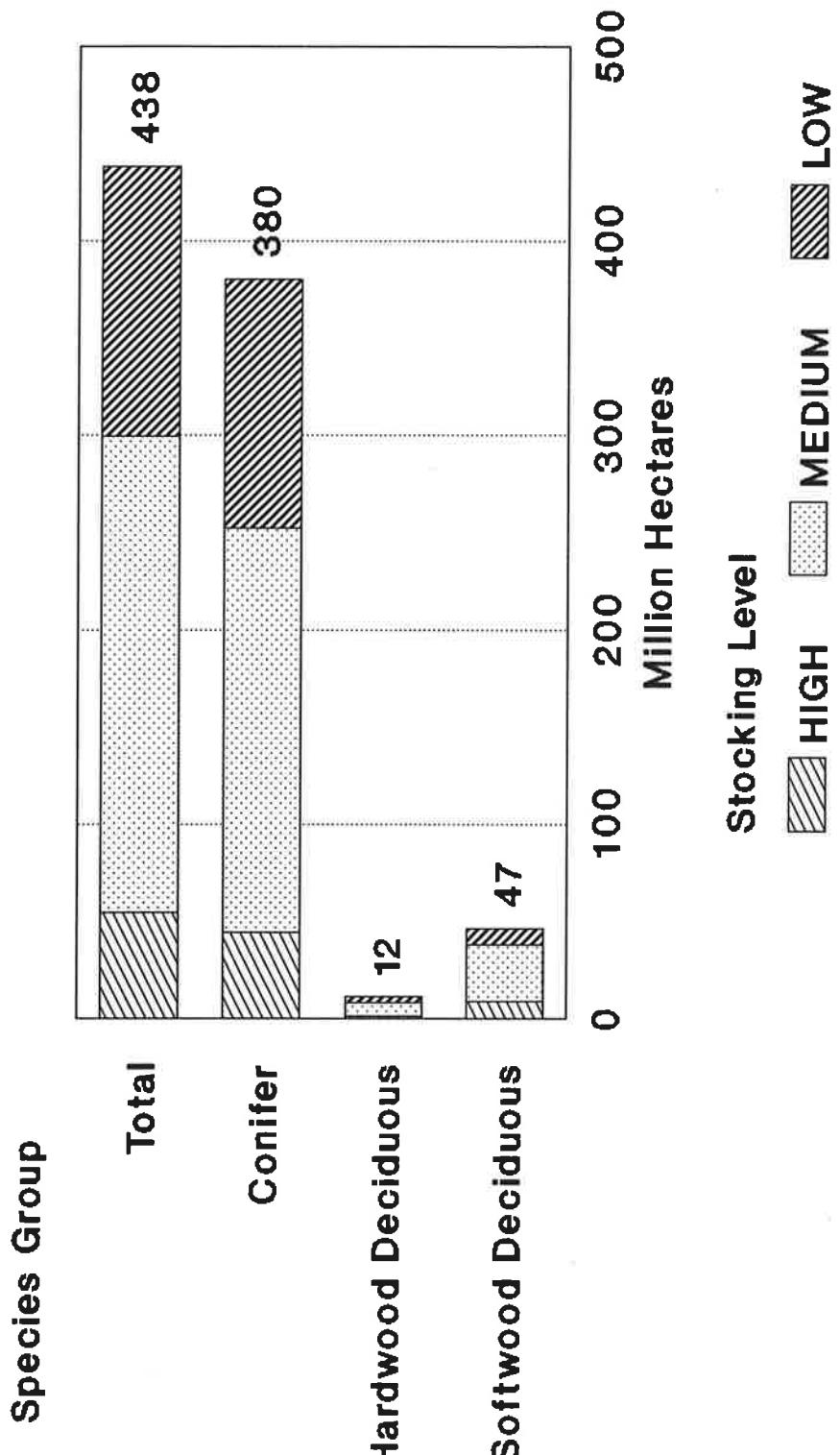
Tables C75 and C76 show that the forest area and growing stock in Pacific Asia to be weighted towards the mature and over-mature age classes.¹⁶⁴ **Figure 52** shows that Almost 55 percent of the stocked forest land and accompanying growing stock are located in the mature and over-mature age class. Hardwood deciduous and coniferous species groups are much older than the softwood deciduous species category. While softwood deciduous species contain 30 percent of the stocked forest land in the

¹⁶²Table C72 presents data in greater detail.

¹⁶³Stocking class information is restricted to 438 million hectares containing the principal species located on the combined stocked forest land contained on Groups I, II, and III forests plus forests allocated for long-term uses other than the production of timber. These forests are administered by either *Goskomles* or directly by the timber industry.

¹⁶⁴Information about the age class distribution of the forest resource in the Pacific Asian region is not available to the same level of detail available either for the USSR or European USSR. The general division between immature and mature and over-mature inventory available from data about the forest fund in Pacific Asia has been used.

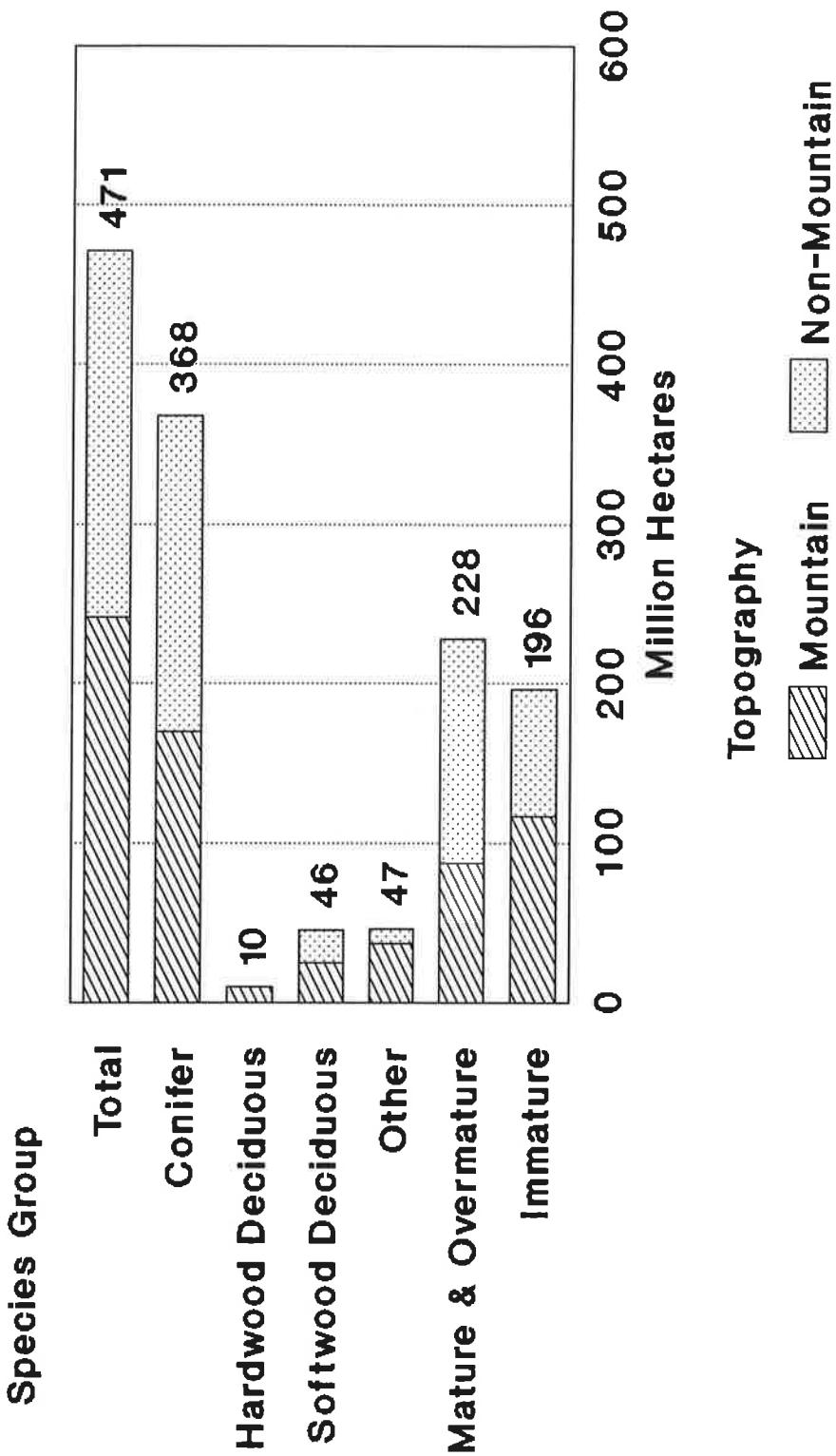
**PACIFIC ASIA REGION STOCKED FOREST LANDS
UNDER FOREST ADMIN BY SPECIES & STOCKING**
Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 51

**PACIFIC ASIA REGION STOCKED FOREST LAND
FOREST ADMINISTRATION BY SPECIES GROUP**
Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 52

mature and older age class, fully 56 percent of the coniferous species and 59 percent of the hardwood deciduous species are contained in that age class.

It is believed that softwood deciduous species are a major colonizing species in forest land which has either been harvested or deforested by natural means. Consequently, poor reliance on artificial means of reforestation in Pacific Asia where almost 75 percent of the regeneration comes from natural means is thought to contribute to the formation of softwood deciduous stands. Since logging has only recently been of some consequence in this region, it is not surprising to see the age class structure skewed towards the mature age classes for the non-softwood deciduous species.

Mountain Forests

Mountain forests of the USSR are primarily located in the Pacific Asian region which contain more than 90 percent of the mountain forest area (or 370 million hectares) and 87 percent of the growing stock (or 29 billion cubic meters). Table C73 shows that nearly 81 percent of the stocked mountain forest is located in Group III forests. Group I forests account for almost 15 percent and Group II forests account for 5 percent. A similar share of the growing stock is so distributed (Table C74). While mountain forests in general account for 50 percent of the stocked forest land of the region, the share within each group of forest is somewhat different. While 54 percent of Group I forests and 50 percent of Group III forests are classified as mountain forests, nearly 95 percent of the Group II forests are classified as mountain forests.

As Tables C75 and C76 show, mountain forests form a major part of the forest resource of the Pacific Asian region where mountain forests represent 51 percent of the stocked forest land and 53 percent of the growing stock. Most of the mountain forests allocated for non-timber long-term uses are situated in this region. Of the 27 million hectares of mountain forests in long-term uses, 25 million are situated in Pacific Asia. **Figure 52** shows the distribution of stocked forest land between mountain and non-mountain forests.

In Pacific Asia, nearly all of the hardwood deciduous specie resource is located in mountain forests. The shares of the coniferous and softwood deciduous resource in mountain forests amount to no more than 50 percent of the resource. A significant portion of the mature and over-mature volume in the Pacific Asian region also falls in

the mountain forest categories. Mountain forests contain 33 percent and 64 percent of the respective regions mature and over-mature timber resource.

Larch species have the largest share of growing stock in mountain forests, accounting for almost 50 percent of the growing stock. Pine contributes only 6 percent of the mountain forest volume. Spruce accounts for 7 percent and true fir for 4 percent.

Accessibility

Soviet reserve forests are primarily located in the Pacific Asian region. This region accounts for more than 90 percent of all Soviet reserve forests. Nearly 35 percent of the regional stocked forested land is contained in reserve forests which support almost 20 billion cubic meters of mature and over-mature growing stock.¹⁶⁵ Mature and over-mature volume which is presently and potentially accessible amounts to 15 billion cubic meters. Most of this is located in Group III forests. Minor amounts are in Group I and Group II forests. Nearly 90 percent of the volume consists of coniferous species.

Almost 438 million hectares of stocked forest land located in the Pacific Asian region are under the administration of the forest authorities including that allocated to non-timber long-term uses. Some 169 million hectares are located in reserve forests. Thus, almost 269 million hectares remain as potentially available for timber harvesting. After accounting for forest land which is classified as having site classes of 5a and lower, only 242 million hectares of forested land is actually and potentially suitable and available for use by the industry.

In addition to the forest resource managed by the forest authorities, there are approximately 17 million hectares of stocked forest land supporting nearly 2 billion cubic meters of growing stock managed by agricultural and other non-forest authorities. When this land (all of which is believed to be currently accessible and classified as having site classes greater than or equal to 5), the accessible forest

¹⁶⁵The AAC in the reserve and inaccessible forests in the Asian USSR is 197 million cubic meters. The share of AAC in Pacific Asia is 183 million cubic meters. There are 21.8 billion cubic meters of Growing stock which are in reserve or inaccessible forests. Thus, there are $\{(183/197)*21.8\}$ 20 billion cubic meters. This assumes a high degree of correlation between the AAC and level of mature and over-mature inventory.

resource grows to 259 million hectares supporting more than 16 billion cubic meters of growing stock.

Allowable Annual Cut

An AAC is reported for forests managed by the forest authorities excluding those forests allocated for non-timber long-term uses. The AAC in forests which are accessible and potentially accessible amount to an estimated 279 million cubic meters. The estimated AAC from agricultural land and land set aside for other non forest ministries and organizations amounts to about 9 million cubic meters.¹⁶⁶ Therefore, the total AAC from all accessible and potentially accessible forested land in the forest fund is approximately 288 million cubic meters. An addition 182 million cubic meters is available from reserve and inaccessible forests. Thus, the AAC from the forest resource in the forest fund approaches 470 million cubic meters. Clearly, the potential in reserve and inaccessible forests is not something that can be easily ignored and is the subject of much present speculation.

Forest Agency AAC

The official allowable annual harvest in the Pacific Asian region of the USSR amounts to nearly 280 million cubic meters. In addition, another 182 million cubic meters is potentially supported by forests in the reserve and inaccessible stands. Most of the AAC in the reserve forests comes not unexpectedly from the coniferous species component.

The AAC in the Pacific Asian region has not fluctuated to the same extent as has the AAC in the European USSR (which has declined 11 million cubic meters since 1980). The decline in the AAC of Pacific Asia amounted to only 2.6 million cubic meters. (Table C42)

Outlook for AAC

The forest resources of the Pacific Asian region have not been subjected to the same analysis to which the forest resources in the European USSR were recently subjected. However, the Soviet Union forest establishment is very sensitive to the condition of

¹⁶⁶Vorob'yev, G. I. et alia, *Ekonomicheskaya Geografiya Lesnikh Resursov SSR*, page 56.

the forests and have expressed concern over the long run sustainability of the AAC.¹⁶⁷

The AAC from reserve and inaccessible forests may not be realizable in the future because of a host of environmental and economical problems associated with regional development. The AAC which is presently accessible or potentially accessible is probably overstated. While it is difficult to assign an estimate to this, it is believed that the figure of 10 percent derived for the European USSR is undoubtedly appropriate. Thus the AAC in the presently accessible stands probably amounts to not more than 100 million cubic meters. The potential AAC (in the potentially accessible stands) should also be discounted to account for likely environmental and transportational problems. While the overall discount applied to the AAC has been about 10 percent, a reduction of almost 20 percent for the remaining AAC would be more appropriate to account for the more severe environmental conditions connected with the Pacific Asian region. Thus, the AAC in the potentially accessible forest resource amounts to nearly 135 million cubic meters.

HARVEST

Table C30 showed the "official" harvest in the Pacific Asian region of the USSR has increased dramatically since 1940 when only 36 million cubic meters were harvested. By 1989, the harvest had risen to almost 115 million cubic meters representing nearly 30 percent of the total Soviet harvest. The decrease in harvest which has occurred since 1960 in the European USSR has primarily been mirrored in the increase for the Pacific Asian region, where a rise of 45 million cubic meters has occurred.

Harvest (from the resource managed by the forest authorities) via principal utilization provides the dominant share of harvest in the Pacific Asian region amounting to 105 million cubic meters. An uncertain share (but what is believed to be the majority), comes from clearcutting. Almost 4 million cubic meters is thought to originate from intermediate utilization. At least 5 million cubic meters is considered to come through other utilization.

¹⁶⁷Lesopol'zobaniye na Dal'nem Vostoke: Problemi i puti ikh Resheniya, Sukhikh, V.I., and Efremov, D. P., Lesnoye Khozaustvo, July 1990, page 2 - 7

Utilization of the AAC

Coniferous species account for 91 percent of the Pacific Asian harvest while softwood deciduous species account for 8 percent of the harvest.¹⁶⁸ Hardwood deciduous species account for only one percent of the harvest as of 1989. The utilization of coniferous species is higher than in the other specie groups reaching 41 percent of the AAC. Utilization of the softwood deciduous species was only 12 percent compared to the AAC. On the other hand, utilization of the hardwood deciduous species was nearly 20 percent of the AAC although the hardwood deciduous AAC accounted for only two percent of the region's AAC.

Allocation of the collective farm harvest and harvest from small operators among the four regions is not available. However, it is believed that this AAC is fully utilized.

REGENERATION

Detailed information regarding reforestation activities of the the Pacific Asian region are unavailable. However, it is well known that substantial hectares of land have become non-stocked due to forest fires and diseases. While it seems that the area clearcut is receiving some reforestation attention, most of the fire affected forest land may not. Forest land affected by fire located in the Pacific Asian region amounts to an average of one million hectares of stocked forest land denuded annually since 1985. Attempts to restock this forest land with the most appropriate commercial species are not evident to any significant degree.

PROGNOSIS

The Pacific Asian Region includes some of the most inhospitable parts of the globe, where temperatures have been known to drop far below zero for days at a time. The limits of man and machine are both tested here.

The AAC allocated to the reserve forests and inaccessible stands is not likely to be economically accessible in the near to medium term. Not only does the growing stock represented by this AAC lie outside the existing transportation system and projected routes for the next twenty years, but much of the volume lies in stands of low

¹⁶⁸As with the other regions, a detailed break down of the harvest into the component species groups is not available for recent harvests. Data is available for the harvest in 1982. The ratios for this year are not believed to be significantly different than those in the more recent years.

stocking and low value species.¹⁶⁹ Much of this forest is growing in regions of permafrost, which poses unique and difficult problems for the satisfactory restocking of the lands once harvesting is complete.¹⁷⁰ The most economic harvesting method, clearcutting may not be practical as environmental forces intervene to restrict harvesting practice in order to preserve the integrity of the environment. Thus, this wood must be considered high cost at best and may in fact not be economic to develop even if the environmental forces decide to permit industrial development. Thus, the forest area and AAC presently considered as reserve and inaccessible, should be heavily discounted in harvest projections.

The AAC in the developed and potentially developed forests can be expected to be available in the near to medium term. Initially, an additional harvest in the softwood and hardwood deciduous species may be possible, with minimum infrastructural development. At the present time nearly 40 percent of the coniferous species component is being harvested compared with 12 percent and 20 percent of the softwood and hardwood deciduous components. Assuming that an additional harvest up to 40 percent of the deciduous components is possible, an extra one million cubic meters of hardwood deciduous timber and an extra 6 million cubic meters of softwood deciduous timber are possible, totalling nearly 7 million cubic meters.

Beyond this extra volume which is believed to be from forests already developed and accessible, an additional potential AAC of about 135 million cubic meters is "developed" in the sense that it is located within 200 kilometers of major

¹⁶⁹Land site class 5a and below in reserve forests contain 60 million hectares of stocked forest land, accounting for almost one third of all stocked forest land, only 70 percent of the stocked forest land in reserve forests are thought to meet the thresh hold volumes per hectare to support economic activity.

¹⁷⁰Since only the top few meters of soil thaw during the warmer months, from spring through to early fall, the water table becomes elevated. Water has no where to drain and must follow the contours of the terrain. Marking of the land surface by harvesting vehicles and/or scars left from cable skidding contribute to the channelling of water along narrow paths increasing the erosion.

The forests of the north have evolved over a number of years. Each successive generation of tree cover has modified the environment surrounding it sufficiently to allow hitherto polar desert to have sufficiently higher temperatures to support tree growth and development. Clearcutting effectively pushes the stage of succession back making it more difficult to establish a forest resembling the forest that was removed.

transportation routes.¹⁷¹ Additional major investment in infrastructure is needed to make this AAC available for harvest. Estimates by Soviet sources place the capital cost to be between 170 thousand and 220 thousand roubles per cubic meter of AAC developed.

Much of the forest reserve land in Pacific Asia is located in mountain forests where terrain is less hospitable for land harvesting vehicles. At the present time, successful harvesting techniques are available on a wide scale basis for stands on slopes no steeper than 20 to 25 degrees. An estimated additional 15 million cubic meters of AAC is developed in all ways except for the investment in appropriate technology widely available in the west to remove wood from steeper slopes.¹⁷² Most of this volume is thought to be coniferous species. Logging and transportation costs will be substantially higher, raising questions about the economic feasibility of the requisite capital investments, particularly under pending cost and price reforms.

Access is related to capital investment through either domestic or foreign sources. In addition, much of the current and potential AAC is thought to be located in zones of permafrost which pose daunting obstacles for reforestation. Special harvesting techniques and or ban of actual harvesting in any form may severely curtail the outlook for addition harvest from the current harvest levels.

Increments in volumes from thinning beyond the present 4 million cubic meters are not expected to amount to significant volumes in the near to medium term. A successful program for intermediate utilization requires a well developed local market and advanced technology, both of which are lacking in Pacific Asia. Increases from other utilization are tied to industrial development. If the Soviet Union or the separate

¹⁷¹Vorob'ev *et alia* in "Ekonomicheskaya Geografiya Lesnikh Resursov SSSR" on pages 303 and 304 discuss the impact of the construction of the BAM railway on the accessibility of the forest resource. Forest resource within a distance of between 150 and 200 kilometers from the railway was considered to be within the BAM zone, and therefore to be potentially developable.

¹⁷²During an expedition to the Soviet Far East by the authours in the fall of 1990, our investigations revealed that some Soviet officials believe that an additional 10 million cubic meters of AAC from Far East forests was possible with the introduction of technology already available in the West to harvest wood from steeper slopes. Mountain forests in the Far East are approximately twice as common as in the East Siberia. Thus, it is assumed that a similar proportion of incremental AAC would be available from this region. Therefore, introduction of new technology could lead to an increase of an estimated 15 million cubic meters *ceteris paribus*.

regions are successful at developing and implementing a strategy to shift to a market economy, then the size of the harvest under other utilization could increase substantially. However, in the near to medium term, we do not expect this to occur.

DISCUSSION

The Forest Resource and Industry

The European region contains the majority of the population and forest industrial activity accounting for 74 percent of the population, 61 percent of the harvest, 63 percent of the lumber production, 84 percent of the plywood production, and 84 percent of the paper and paperboard production. While containing only 24 percent of the stocked forest land and 28 percent of the growing stock, the European region accounts for almost 40 percent of the current and potentially accessible AAC. Pacific Asian USSR, on the other hand, contains the majority of the forest resource but is underdeveloped in terms of industrial activity. Pacific Asia accounts for 63 percent of the stocked forest land and 59 percent of the growing stock. Not surprisingly, over 90 percent of the reserve and long-term inaccessible forest resource is located in Pacific Asia. In addition, it includes only 6 percent of the population, 29 percent of the harvest, 24 percent of the lumber production, 12 percent of the plywood production, and 11 percent of the paper and paperboard production. The Transition RSFSR region is located between these two major regions of the Soviet Union, and thus has a more balanced pattern. While containing 11 percent of the stocked forest land and 13 percent of the growing stock, it accounts for 5 percent of the people, 9 percent of the harvest, 9 percent of the lumber production, 3 percent of the plywood production, and one percent of the paper and paperboard production. Central Asia is a minor contributor to the forest industry of the Soviet Union. **Figure 53** shows how important the European USSR is to the forest industrial complex of the Soviet Union.

The European USSR and the Transition RSFSR regions have the least rugged terrain, evident from **Figures 54 and 55**. Mountain forests account for only 14 percent of the stocked forest land and 17 percent of the growing stock in the European USSR and 10 percent and 11 percent in the Transition RSFSR. In both the Central Asia and the Pacific Asian regions, mountain forests account for more than 35 percent of the stocked forest land and more than 50 percent of the growing stock.

The large difference in terrain impose broad restrictions on the species make up of the forest resources in each of the four regions. The European region, due to more temperate climate, contains a disproportionately higher share of the deciduous resource. While deciduous forests account for only 13 percent of the stocked forest land and 10 percent of the growing stock in the Pacific Asian region, in both the

EUROPEAN USSR Share of Soviet Union National Statistics

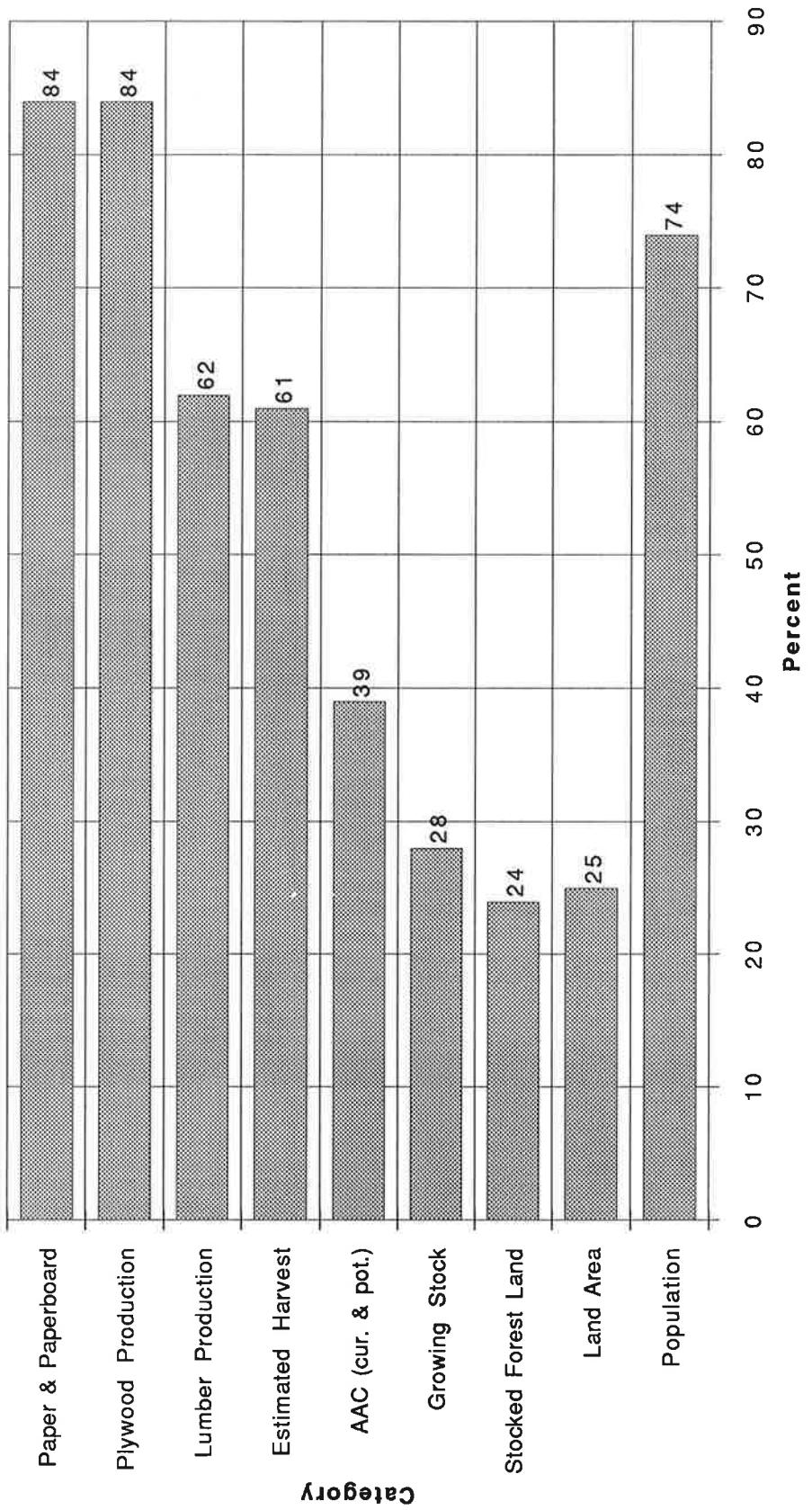
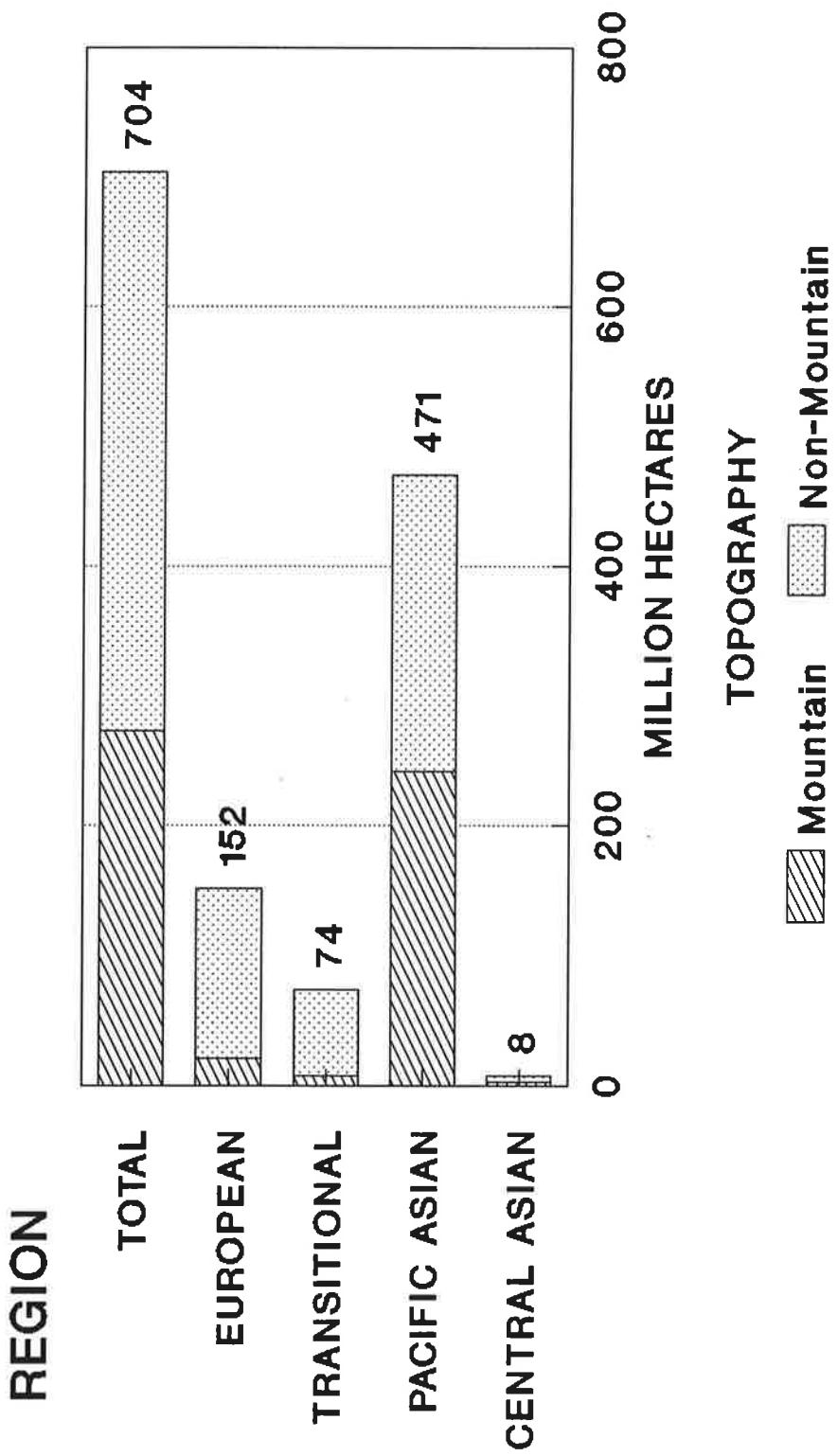


Figure 53

Source: CINTRAFOR/cab

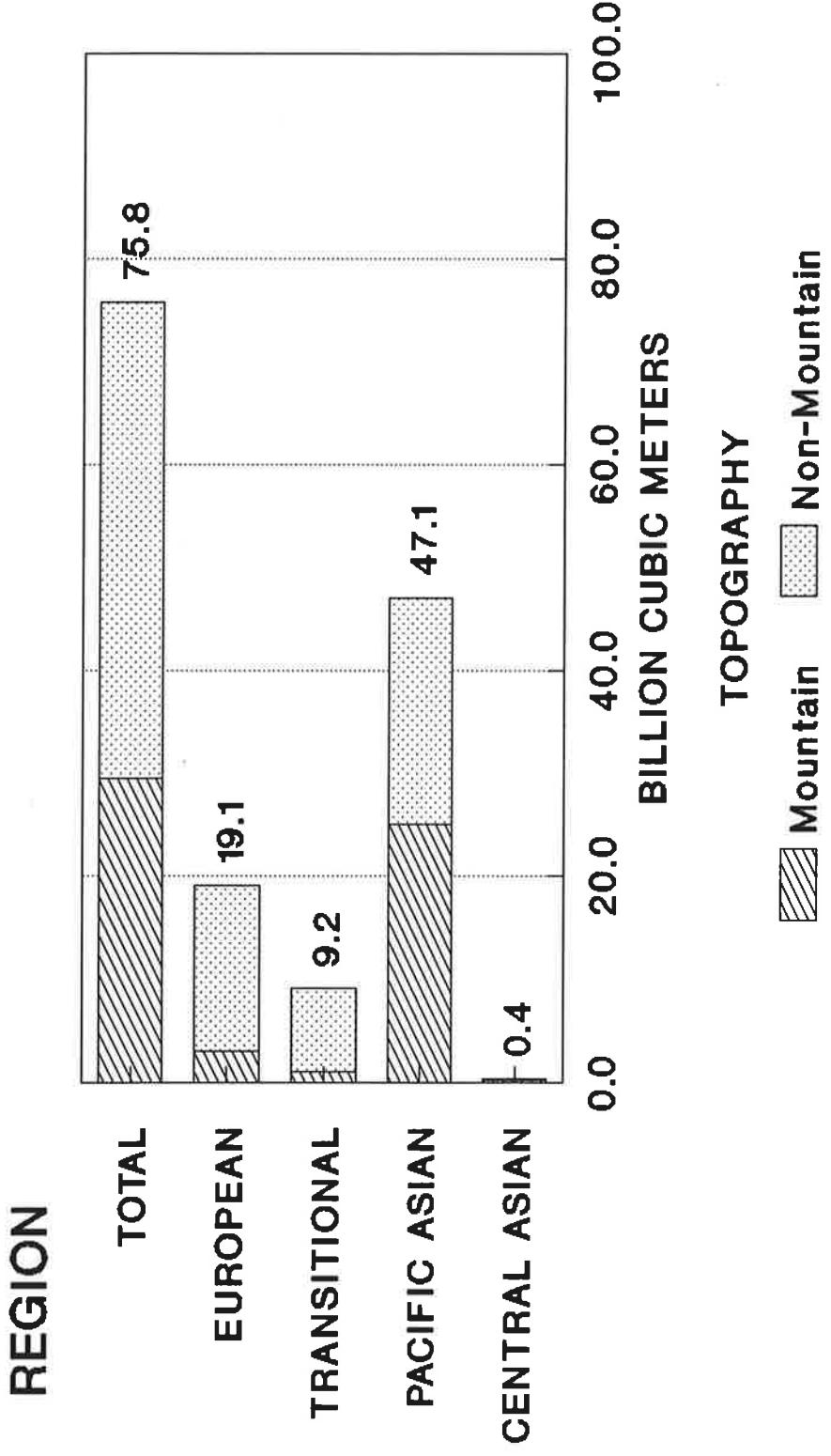
USSR STOCKED FOREST LAND BY REGION UNDER FOREST ADMINISTRATION MOUNTAIN AND NON-MOUNTAIN



CINTRAFOR/cab/trw

Figure 54

USSR GROWING STOCK BY REGION STOCKED FORESTS BY TOPOGRAPHY (UNDER FOREST ADMINISTRATION)



CINTRAFOR/cab/trw

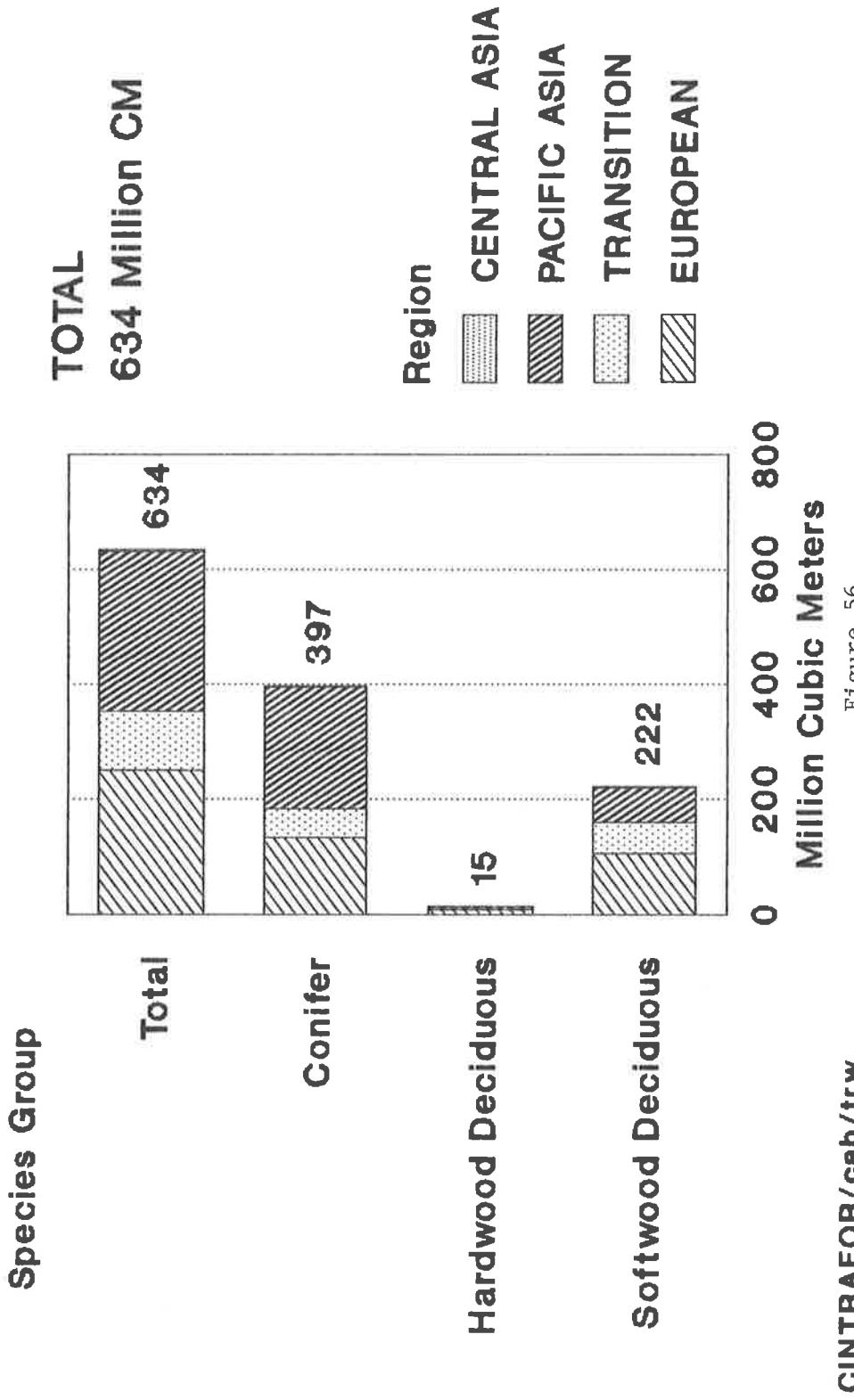
Figure 55

European USSR and the Transition RSFSR, the deciduous resource occupies more than one-third of the total forest resource. In Central Asia, the deciduous resource dominates the forest fund, accounting for nearly 70 percent of the stocked forest land and more than two-thirds of the growing stock. The distribution of the forest resource among the three principal species groups is reflected in the allocation of the AAC, shown in **Figure 56**. While accounting for approximately one half of the AAC in the European and Transitional RSFSR regions, coniferous species contribute almost three-quarters of the regional AAC in the Pacific Asian region. Just over one half of the coniferous AAC for the total USSR is located in the Pacific Asian region. The AAC from deciduous species, on the other hand, account for almost fifty percent of the regional AAC in each of the Transitional RSFSR and European USSR region. The European region alone accounts for 62 percent of the hardwood deciduous AAC and nearly 50 percent of the AAC from softwood deciduous species.

While the coniferous resource is the dominate species group across the country, **Figures 57 and 58** show that the species which compose this group in each of the regions are decidedly different. In the European USSR, spruce and pine account for equal shares amounting to nearly 100 percent of the coniferous resource. While pine is the major species in Transition RSFSR, occupying one half of the coniferous forested area, cedar pines contribute the next largest share of 22 percent of the stocked coniferous forest land and 28 percent of the coniferous growing stock. Spruce and larch account for most of the remainder. Larch dominates the forest resource of Pacific Asia, occupying almost three-quarters of the forested land and nearly 60 percent of the growing stock. Pine is the next major specie, accounting for only 12 percent of the forested land and 16 percent of the inventory volume. Spruce and cedar account for most of the remainder. Birch and aspen account for the majority of the deciduous resource except in Central Asia where the principal deciduous species are those species commonly encountered in desert environments.

The age structure of the forest resources also differs across the regions, shown in **Figures 59 and 60**. Since the European USSR is the most developed region and has supported the dominate share of the harvest over most of this century, it is not surprising to see that immature stands predominate, accounting for 53 percent of the forested area and 60 percent of the growing stock. In the Transition RSFSR and the Pacific Asian regions, because development started in earnest only after the Second World War, the forest resource is predominantly mature and over-mature. Mature and

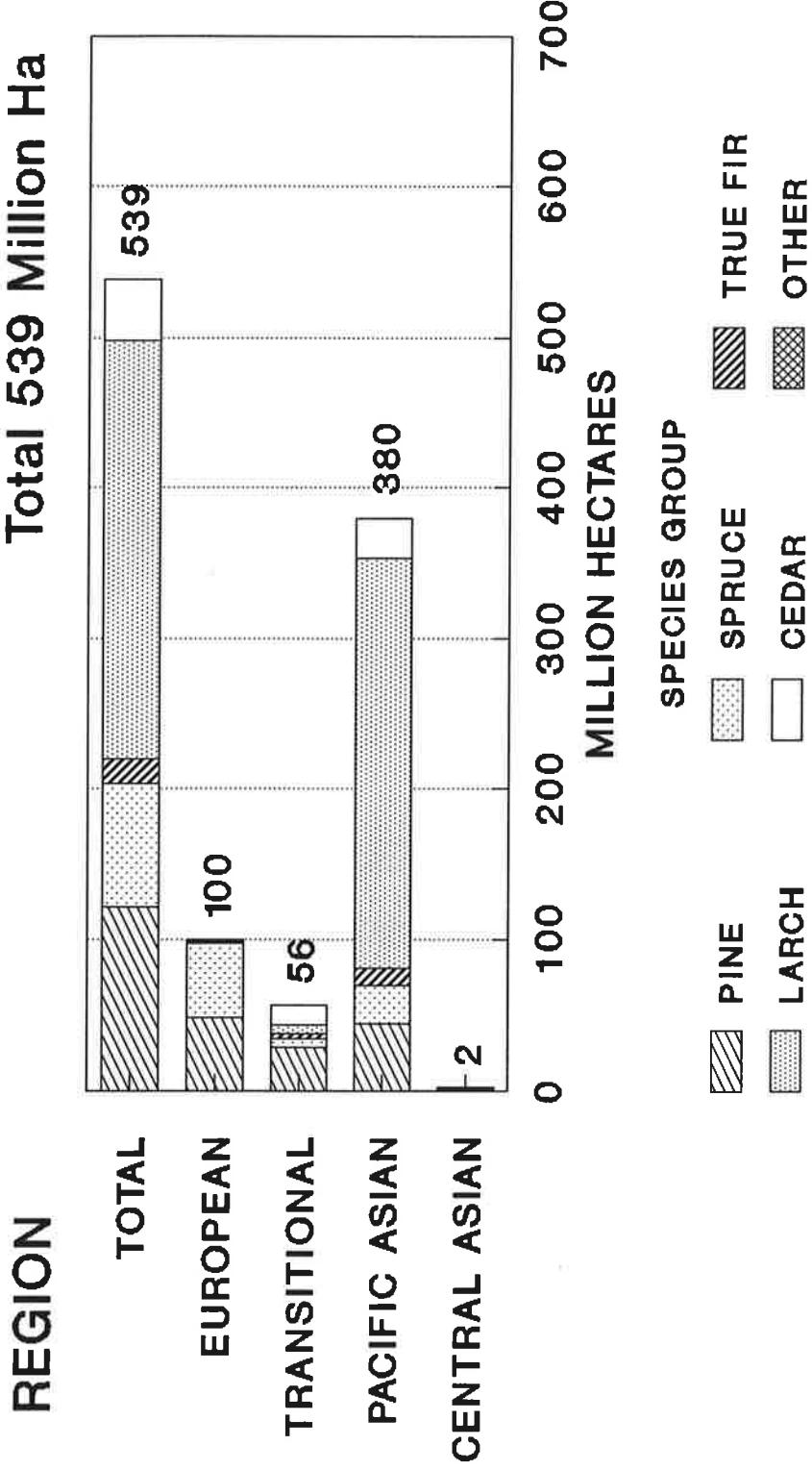
ANNUAL ALLOWABLE CUT UNDER PRINCIPAL UTILIZATION BY REGION & SPECIES GROUP
Ministry of Forestry and Forest Industry



CINTRAFOR/cab/trw

Figure 56

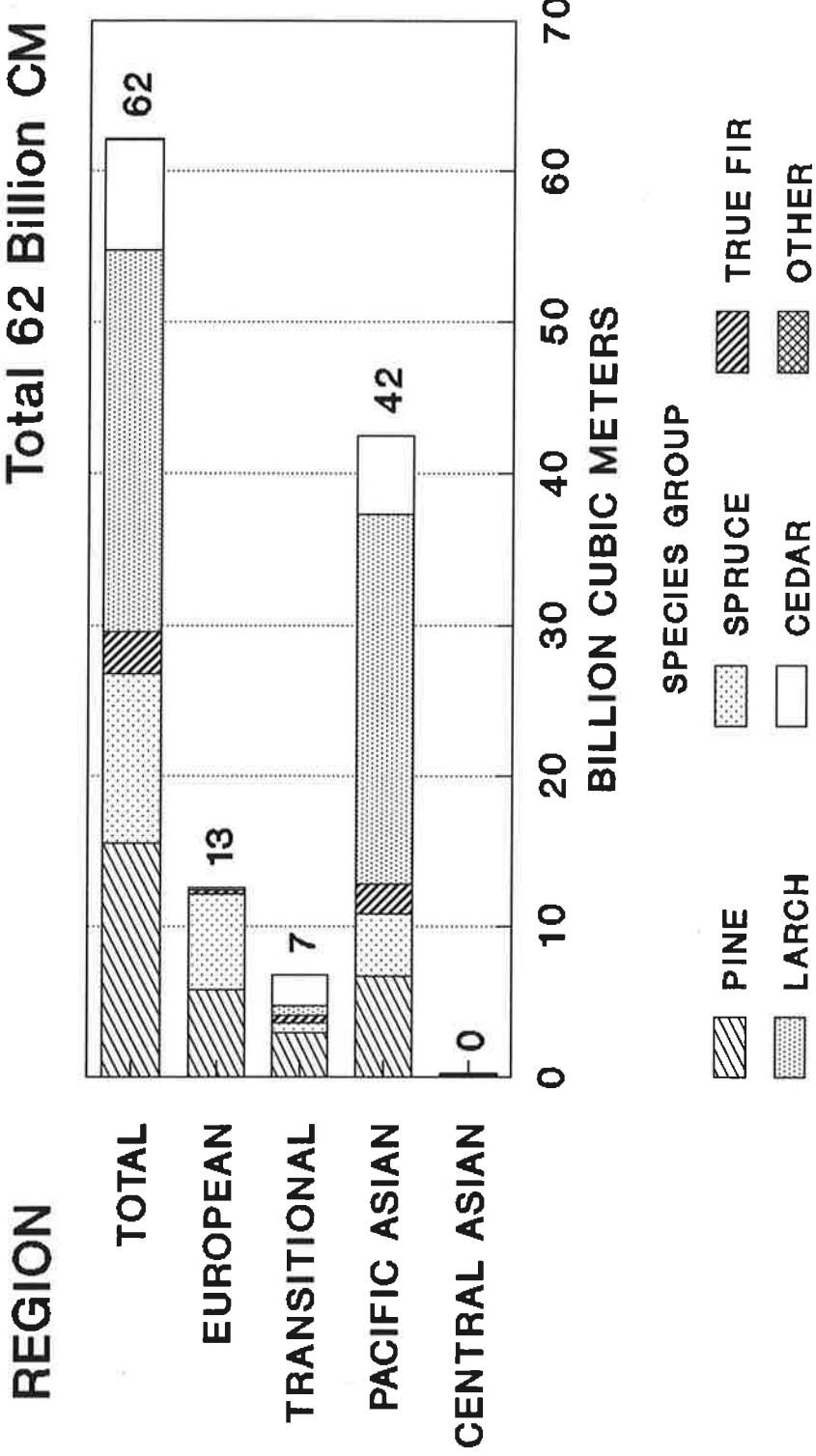
USSR STOCKED CONIFER FORESTS UNDER FOREST ADMINISTRATION BY REGION AND MAJOR SPECIES



CINTRAFOR/cab/trw

Figure 57

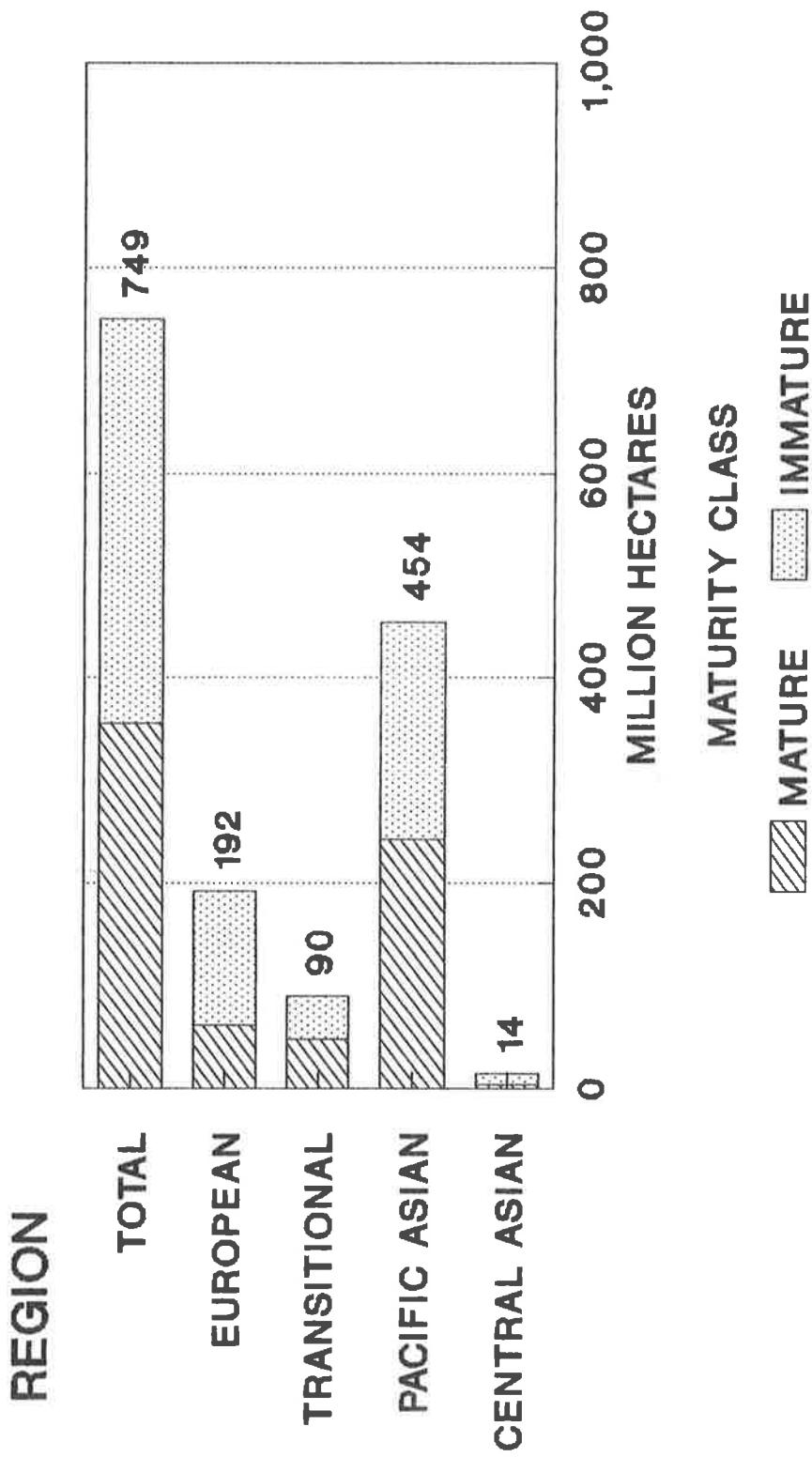
USSR CONIFER GROWING STOCK UNDER FOREST ADMINISTRATION BY REGION AND MAJOR SPECIES



CINTRAFOR/cab/trw

Figure 58

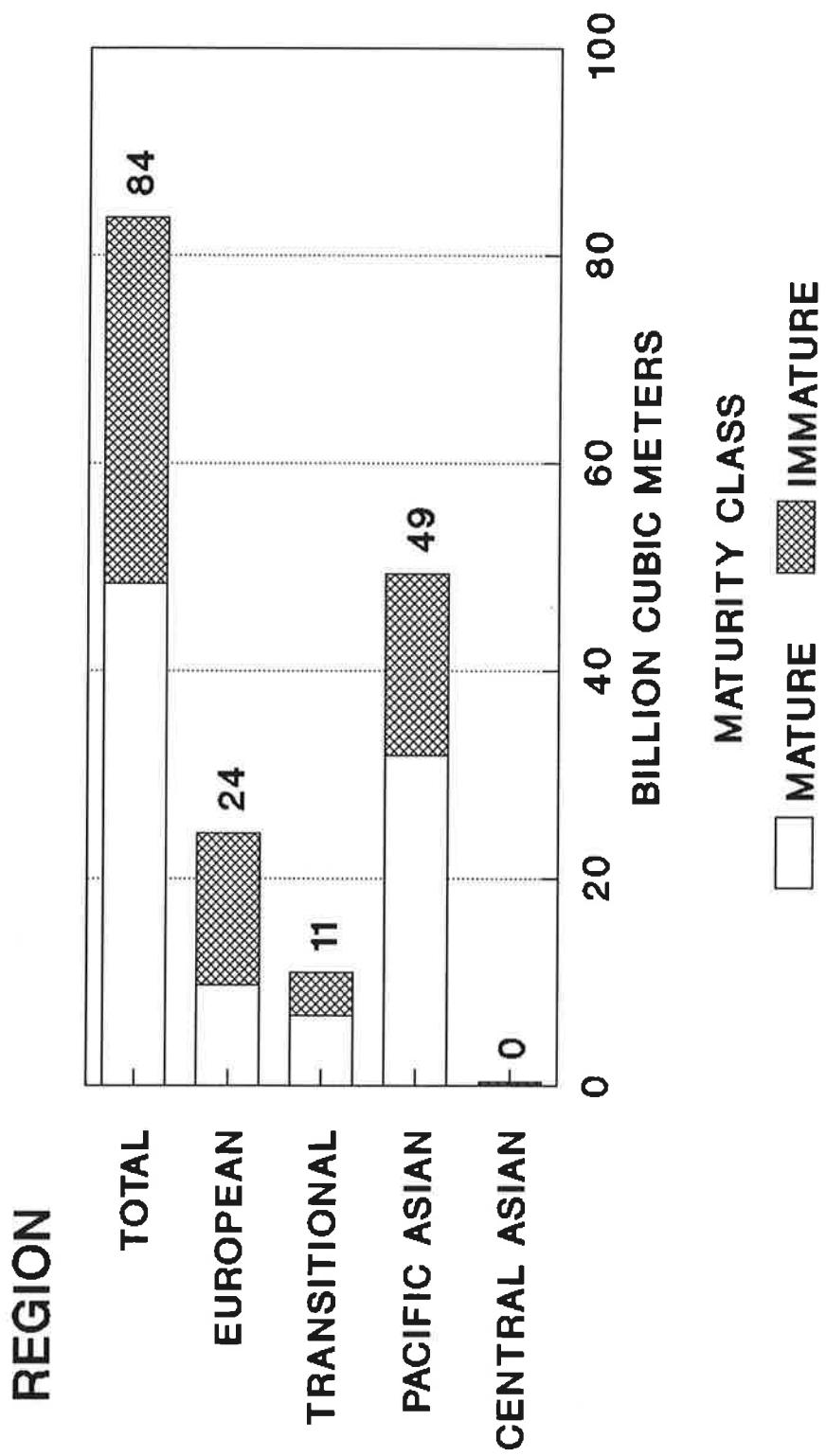
USSR STOCKED FOREST LAND WITH MAJOR SPECIES GROUPS BY STAND MATURITY AND REGION



CINTRAFOR/cab/trw

Figure 59

USSR GROWING STOCK ON STOCKED FORESTS OCCUPIED WITH MAJOR SPECIES BY STAND MATURITY AND REGION



CINTRAFOR/cab/trw

Figure 60

over-mature forests account for 53 percent of the forested land and more than 60 percent of the growing stock of these two regions respectively. The forests of Central Asia consist mainly of immature stands which account for more than three-quarters of the stocked forest land and nearly two-thirds of the growing stock. The generally younger age structure of the forests is due to a strong afforestation program started in the region to prevent further encroachment of the desert areas onto the cultivated and habitable parts.

Outlook for the Harvest

As the European region supports the largest share of the harvest (and other industrial activities as well), but contains only 40 percent of the accessible and potentially accessible resource, it is not surprising to see the allowable annual cut nearly completely utilized (**Figure 61**).¹⁷³ The AAC in the Transition RSFSR and the Pacific Asian region account for nearly 60 percent of the accessible and potentially accessible AAC. However, no more than 40 percent of the resource is being utilized. The balance of the unutilized AAC requires substantial investments in infrastructure to bring it to the developed stage. An insignificant share of the AAC is located in Central Asia, amounting to less than one percent or 3 million cubic meters. Thus most of the potential for harvest increase is located in the Asian Pacific and Transitional RSFSR regions.

The Soviet Union exports unprocessed logs to markets around the world. Log exports were, on average, almost 19 million cubic meters between 1985 and 1989. Asian markets, primarily Japan and China, imported on average about 9 million cubic meters per year while European markets imported nearly 10 million cubic meters. Generally, logs exported to Europe originate no further than the western reaches of the Transition RSFSR. Exports to Asian markets as a rule originate solely from the Pacific Asia region.

Since the annual "official" wood deliveries have averaging nearly 385 million cubic meters, log export trade has accounted for only about 5 percent of total production and slightly over 6 percent of the industrial roundwood production. As a share of

¹⁷³In fact, Soviet authorities continually make reference to chronic overcutting (of the European region) which in 1989 amounted to 19 million cubic meters. Thus, while "official" statistics would suggest that the forest industry is operating within a sustained yield guideline, the forest resource may in fact becoming depleted.

SOVIET UNION HARVEST VS AAC BY REGION 1989
(Accessible/Potentially Accessible)

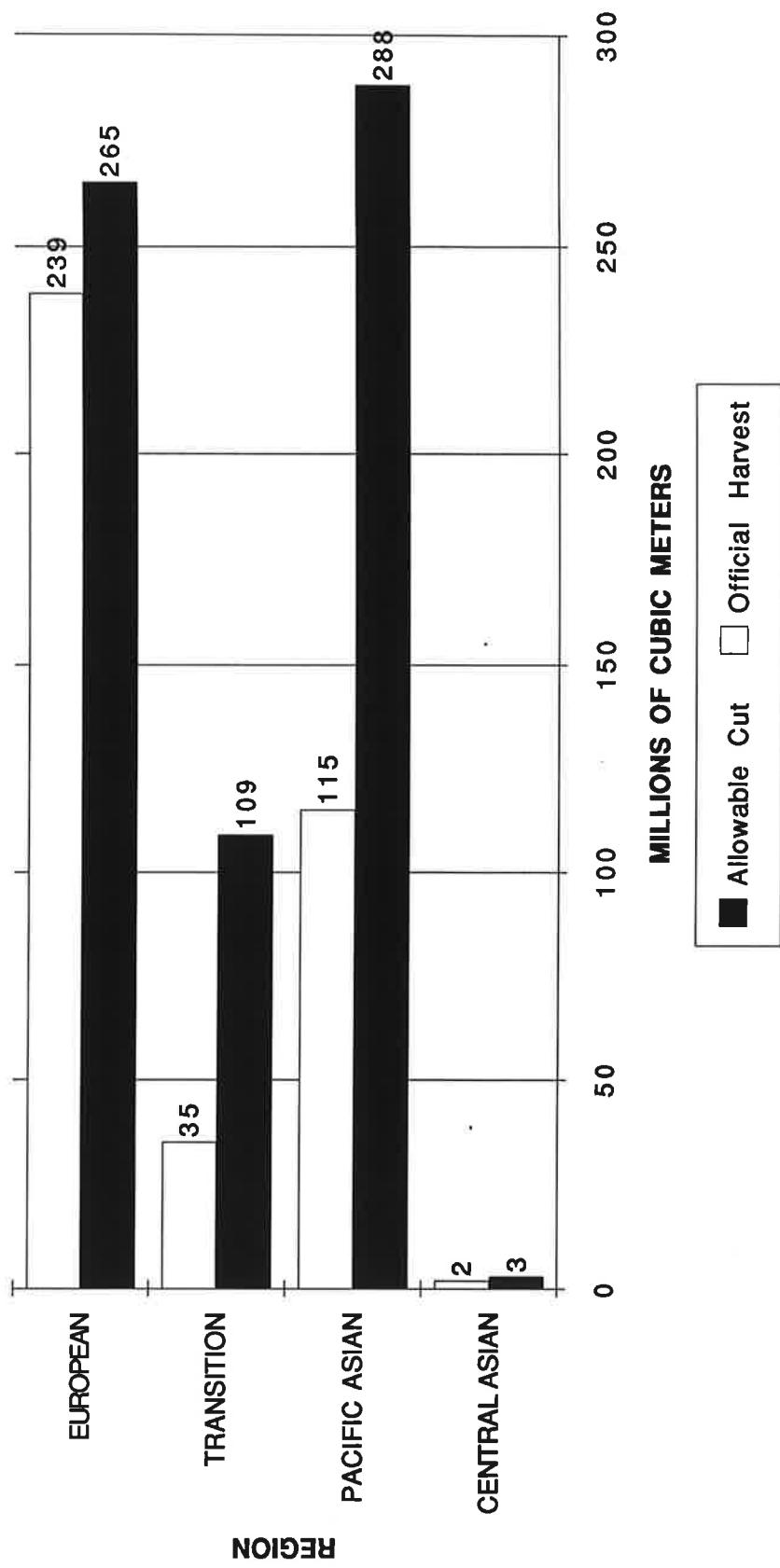


FIGURE 61

Pacific Asian regional production, the export share is somewhat higher, reaching 8 percent of both total roundwood production and commercial wood production for the period 1985 through 1989 inclusive. Exports to Europe, on the other hand, account for slightly less than 4 percent the combined total roundwood production of the European and Transition Regions, and 4 percent of the European regions harvest alone. When commercial harvest is considered, the share of roundwood production exported to European markets climbs to 5 percent. In addition, net exports to Central Asia of between 5 million and 6 million cubic meters are believed to have originated primarily from the Transitional RSFSR and Pacific Asian regions. The internal Soviet exports to Central Asia account for almost 10 percent of the commercial harvest of the Transition RSFSR region. In addition, the forest industry in Transitional RSFSR also is reported to export a sizeable share of its output to the European USSR, which in the late 1970's amounted to almost 2 million cubic meters.¹⁷⁴ Pacific Asia is believed to export almost 3 million cubic meters to Central Asia and almost 9 million cubic meters to European USSR. **Figure 62** shows the "official" production levels, inferred exports to international markets, and estimated transfers within the four regions of the Soviet Union.

Thus, it is possible to hypothesize four roles played by the four regions. In addition to supplying the needs of the domestic industry, the non Central Asia regions must also seek to meet export commitments which in the past five years have mounted to between 15 million and 20 million cubic meters, or almost 5 percent of the "official" harvest of nearly 385 million cubic meters. Approximately half of the log exports have been destined for Asian markets of China and Japan. The remaining half has been exported to East and West Europe. Since exports to Asian markets originate no further west than Pacific Asia, the forest industry in Pacific Asia must in addition to domestic and other internal demands to the USSR, also meet the export requirements of the Pacific Basin. Correspondingly, the forest industry in the European USSR must also consider the market needs in Europe. Transitional RSFSR, thought to be a marginal supplier for international export markets, also provides raw material for the industry of the European USSR in addition to meeting its own internal supply needs.

¹⁷⁴Vorob'yev, G. I. et alia, *Ekonomicheskaya Geografiya Lesnikh Resursov SSR*, page 289

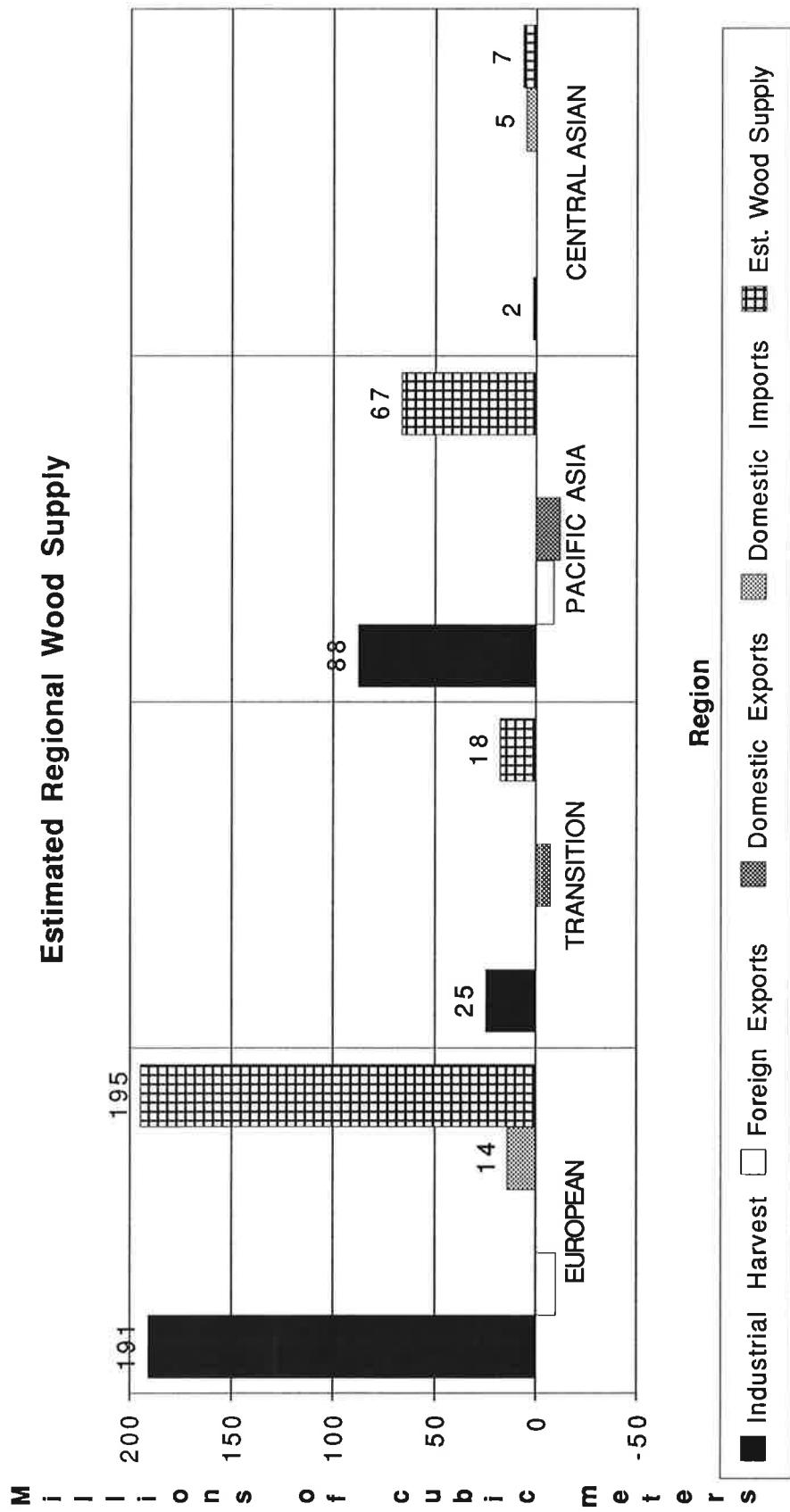


Figure 62

Source: CINTRAFOR/cab

The export of unprocessed logs is one of the commodities which the Soviet Union currently is successful in exporting to markets where payment is in hard currency. There will likely be pressure to maintain unprocessed log exports, at least in the short to medium term, in order to generate hard currency necessary to finance the import of needed equipment and consumer goods. At the same time, the consumption of wood fibre has been projected to increase by up to 100 million cubic meters in the near to medium term.

While it is projected that 60 percent to 70 percent of the needed increase will come from more intensive use of wood residues and by product material, additional roundwood must still be obtained in the amounts of between 30 and 40 million cubic meters. In the absence of major shifts in processing capabilities, most of the projected demand for roundwood is expected to occur in the European USSR where the majority of the population and manufacturing capacity are located. In the absence of decreasing log export, there are questions as to where this additional output can be obtained. **Figure 63** provides an estimate of potential increases in harvest by region possible for the short, medium, and long-term time.

Most of the potential increases in the near to medium term are expected to occur in the European and Transition RSFSR regions. Almost 36 million cubic meters of deciduous species are thought to be accessible subject to securing the appropriate manufacturing technology. An additional 10 to 12 million cubic meters consisting of two-thirds coniferous species (pine and spruce) and one third deciduous species (75 percent birch and 25 percent aspen) can be generated simply by changing the regulations governing harvest from Group I forests. In addition, introduction of fiscal incentives to compensate for the higher harvesting costs connected with selective harvesting techniques could increase volume from intermediate harvesting by 30 million cubic meters. Only half of this is thought to be of commercial quality however. The high cost connected with this source of incremental volume makes it sub-marginal; and thus is not factored directly into the analysis.

This suggests that the ceiling on the level of potential increases in harvest from both European USSR and Transition RSFSR regions is in the neighbourhood of 45 million cubic meters. But how does this compare with the projected fall down in AAC connected with industrial pollution and past forest management practices? The projected decline in AAC for the European USSR alone due to migrant air pollution is

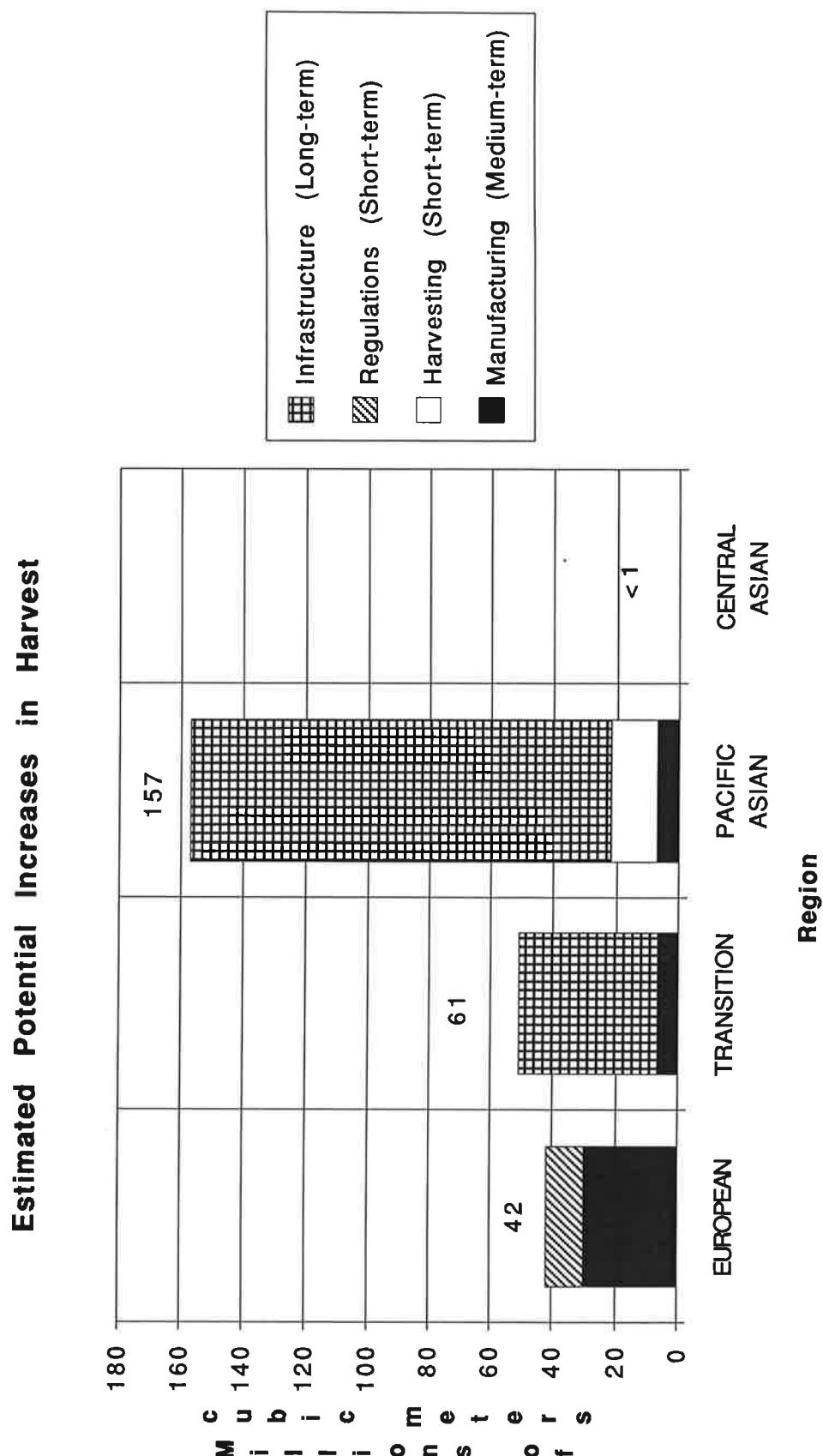


FIGURE 63

SOURCE: CINTRAFOR/cab

thought to be almost 25 million cubic meters, probably exceeding 35 million cubic meters if the shortfall is projected to incorporate the Transition RSFSR region. The reserve and inaccessible forest resource in both European USSR and Transition RSFSR represented by about 20 million cubic meters of AAC is believed to have either high economic or high environmental costs associated with it. Thus, it is unlikely that additional wood volume can originate from these forests.

At the present time, the AAC in the European USSR appears to be "fully" utilized in our view. Thus, the decrease in AAC must translate into a decreased harvest since there is no reserve AAC in the potentially accessible forest resource to take up the slack. Thus, the increased harvest connected with greater utilization of the deciduous species and incremental harvest from Group I forests is expected to more or less compensate for the long-term fall down arising in the European USSR region, and not to any significant increase in total long-term output.

In the short term in the Transition RSFSR region, the harvest might be increased by 6 million cubic meters of mainly deciduous species if appropriate manufacturing technologies can be introduced. Longer term increases in the Transition RSFSR region are dependant on foreign capital. An additional 55 million cubic meters could be possible but only with the investment of large sums of capital for infrastructure development. However, even with capital investment, the potential harvest increase in West Siberia is far from foreign markets, thus decreasing the attractiveness in the eyes of foreign investors. Therefore, it is unlikely Transition RSFSR will witness any large increase beyond the projected rise in harvest of deciduous species. The projected increase more or less compensates for the potential reductions in AAC believed to be likely from industrial pollution and past forest management practices.

With so much of the reserve forests and remaining unallocated volume, Pacific Asian Region has always seemed like a cornucopia of growing stock, particularly now in light of the restrictions placed on the harvest of timber from federal lands in the United States. However, most of the volume and land area is located in Yakut ASSR and the undeveloped parts of Khabarovsk Oblast.¹⁷⁵ Weather conditions are severe and timber is reportedly of smaller size and poor quality. Stocking per hectare is low, almost 80

¹⁷⁵Yakut ASSR is located in the north-eastern part of the Soviet Union while the undeveloped parts of Khabarovsk region is located on the east coast.

cubic meters per hectare in the reserve forests of Yakut ASSR. This makes development economically marginal at best. In addition, the uncertainty surrounding the regeneration of stands once harvesting is complete in the harsh climates has yet to be resolved.

The combination of low quality and low value species, low stocking, and harsh climate contribute to high operating costs. Together with the uncertain sustainability of the resource, these factors all mitigate against large supplies of wood originating from the reserve forests coming to market from the Asia Pacific region in the short to medium term, let alone over the longer-term.

Some potential additional increases from the stands which are presently developed is possible. By making better use of the deciduous resource believed to be developed (except for the appropriate manufacturing technology) an additional harvest of 7 million cubic meters of deciduous species could potentially be possible. An extra 15 million cubic meters of mainly coniferous species is believed to be accessible at this time in all ways except for the appropriate harvesting technology. Thus, the increase in harvest from either importing the harvesting technology for slopes greater than 20 to 25 degrees or manufacturing processes which can use the deciduous resource amounts to approximately 22 million cubic meters, or nearly 20 percent of the present harvest.

The difference between the stated AAC in the currently and potentially accessible forest land, and the actual harvest, represents the currently undeveloped portion of the "official" AAC. The development of this added volume, estimated to be 135 million cubic meters in Pacific Asia and 55 million cubic meters in Transitional RSFSR, is dependent on capital investment.

What is the outlook for massive capital injections from Soviet sources in the near to medium term? Individual forest enterprises can no longer expect to receive capital infusions from the central government(s). The individual enterprises are currently being placed on a self financing basis under economic and price reforms.

While retaining a share of the hard currency earnings generated by the sale of their products, the share of earnings remaining with the enterprise was reportedly recently reduced from 25 percent to 15 percent for 1991 to assist the central

government to meet its hard currency obligations. Thus the ability of the individual enterprises to import foreign technology in its own right is uncertain and does not look very promising in the near to medium term.¹⁷⁶

One alternative heavily promoted is investment by foreign firms to help bring to production currently undeveloped forest land and provide marketing expertise to facilitate the export of Soviet manufactured products. Backman and Waggener observed that the investment conditions in 1990 were murky, thus clouding the outlook for foreign investors. Since then, a number of joint ventures have started to operate, the most notable being the joint venture between Hyundai and the Primorye forest industry association. This joint venture manages 10 thousand square kilometers of forest land on the sea coast across from Sakhalin Island. The AAC of this concession is approximately one million cubic meters.

While Hyundai has made great strides in developing what is believed to have been forest resource classified as "potentially developable", it is far from clear whether other major foreign companies will decide to make the commitment for investment in the near term. Although very little is expected to take place in the short term, substantial development may be possible in the medium to long-term should the political uncertainties be resolved.

Regardless of the impediments to foreign investment internal to the Soviet Union, the increase in harvest connected with increasing foreign investment is limited by market considerations. The size of the market in which it is possible to receive hard currency and in which Soviet timber (species and quality) are competitive affect the ability of the foreign investor to recoup the investment. The market size in the Pacific Basin for sawlogs of coniferous species was nearly 28 million cubic meters in 1989. The United States supplied approximately two-thirds of the market while the USSR supplied about 20 percent.¹⁷⁷ Through partial substitution, an increase in Soviet exports may be

¹⁷⁶In fact, this reported change in the share of resources retained by the enterprises may not only decrease the likelihood that the firm can increase the harvest in the future, but may actually place the current harvest levels at risk; and thus interfere with ability of the Soviet Union to continue exporting roundwood at present volumes.

¹⁷⁷While the total market size may grow in the future, a recent trip by the authours to Japan suggested that Soviet logs were competing not only against North American logs, but against North American rough cut lumber. Rough cut lumber has shown substantial increases in volume shipped from North America to the Japan market in recent years. Thus, any increase in the

possible. Should the Soviets be able to capture two-thirds of the market for coniferous sawlogs presently serviced from North America, the harvest in the Pacific Asian region would need to increase by at least between 10 and 15 million cubic meters.

demand for the products into which the logs are produced may translate into not an increase in the coniferous log market, but an increase in the market size for manufactured products such as lumber.

CONCLUSIONS

The forest resources of the European USSR are being exploited at or beyond the current ability of the resource to sustain itself. On account of poor harvesting and forest management practices when coupled with a climate which is more favourable to deciduous species (than that existing in the Pacific Asian region), their share of the total harvest is likely to increase in the near to medium term. Thus, while the overall coniferous component is expected to decline, the total harvest will not because of the substitution of hitherto unutilized deciduous resource for the over developed coniferous resource.

Incremental harvest is possible from greater intermediate utilization by increasing the degree of thinning in immature stands. However, without fiscal incentives and new technology to compensate for the higher costs associated with selective harvesting techniques, it is unlikely in the short to medium terms to lead to any sizeable increase.

Thus, any increase in manufacturing capacity of the forest industry in the European USSR must be achieved through a more intensive utilization of existing forest resource, including a shift to greater use of the available deciduous resource.

The potential rise in the harvest of deciduous species in Transitional RSFSR is thought to be sufficient to compensate for the projected decline in the carrying capacity of the already developed forest resource. The decline is believed due to industrial pollution and overutilization of the already developed forest land base. Since there is not a well developed local market for small wood produced from intermediate utilization, additional harvest in the Transitional RSFSR must come through substantial capital investment in the infrastructure. Given the central location of the region viz-a-viz the hard currency export markets, European USSR and the Pacific Asian USSR would have a higher priority.

A nominal increase in the harvest of deciduous species is possible from the Pacific Asian region providing there is appropriate manufacturing technology to utilize the resource. Incremental harvest from forest land already accessible is possible providing that harvesting technology widely available from the West can be imported and put to use. Additional harvest beyond the 20 million cubic meters of already

developed timber depends on the willingness of foreign investors to invest substantial sums in the infrastructure.

Reported administrative changes in the share of hard currency retained by the individual enterprises may seriously undermine the ability of the Soviet forest industry to continue harvesting at current levels, let alone increasing the volume of exports. In addition, as the centrally planned economy shifts to a market oriented one, the ability of the forest industry to replace Soviet made capital stock from within the country may decline. Thus, while harvest increases in the order of 70 million cubic meters seem to be potentially possible with minimum investment in the infrastructure, the ability of the forest industry to attain this harvest may in the short term be deteriorating. Actual declines in the current harvest levels cannot be ruled out.

The joint venture between Hyundai of South Korea and the Primory'e Forest Industry Association of the Soviet Far East demonstrates that there is definite interest on the part of foreigners to cultivate the potential wood supply. However, the interest, particularly in the Pacific Asian region, to invest in developing the harvesting potential depends on the ability of the investment to generate hard currency profits and to be able to repatriate the profits. Given the distribution of the resource and industrial activity, the European USSR is a more likely candidate for investors seeking opportunities in manufacturing and secondary processing while those seeking additional raw material should examine the Pacific Asian region.

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APPENDIX A

VEGETATION ZONES OF THE SOVIET UNION

APPENDIX

VEGETATION ZONES OF THE SOVIET UNION

The Soviet Union forms a major part of the mosaic of forests which cover the globe, occupying almost one sixth of the world's land surface area. The largest share of coniferous forests, which stretch from Alaska and the north western United States through Canada and Scandinavia is located in the USSR. Broad leafed and mixed broad-leafed and coniferous forest occupy the southern part of European USSR. Tundra is located along the far north while steppe and desert are located along the southern reaches of the country.

Tundra

The tundra occupies a narrow strip along the northern reaches of the USSR, extending further south in mountainous areas such as in the Soviet Far East. Snow covers the ground for at least 180 days of the year while mean annual temperature in winter remains below minus 10 ° centigrade. The sub soil remains permanently frozen. During the brief summer period, temperature rises to between 3 ° and 13 ° centigrade and only the top few meters of the soil thaws. Soils become saturated as the water cannot drain because of the permanently frozen soil. The tundra soils are thin, often rocky and poorly formed. The soil lacks air, and thus bacteria and other agents which encourage decomposition. The harsh climatic conditions supports minimal vegetation, primarily small shrubs and herbaceous plants. Forest resources in this zone are nominal.

Tayga (Coniferous Forests)

South, the tundra fades gradually through a transition zone of wooded tundra into the tayga or boreal forest zone. The boundary between tundra and forested zone coincides approximately with the line demarcating an average July temperature of 10 ° centigrade, and extends southwards into Siberia (at latitudes, which if in the European part of the USSR, would support mixed or deciduous zones) as the climate becomes more severe.¹⁷⁷ The zone stretches from the Finnish border in the west to the shores

¹⁷⁷ Coniferous species are tolerant of acidic soils and are equipped to endure very long severe winters. Their limiting temperature is at least one month with a mean monthly temperature of over 10 ° C. and a temperature of over about 6 ° C. for four to five months each year. (Geography of the Soviet Union, Cole, J.P., page 69)

of the Pacific Ocean in the east, and from the tundra zone in the north to mixed forested zones in the south where the mean annual temperatures approach freezing. It can be seen further south in other zones of vegetation along mountain ranges where elevation compensates for the lower latitude. It is in this zone where the majority of the forest resources of the Soviet Union are located.

The soils are characteristic of coniferous vegetation and climatic conditions of low temperature and high humidity. Soil consists of layers of organic matter (acidic humus). Constant moisture contributes to leaching which removes nutrients and creates a sterile layer just below the surface. Permafrost and or iron hard pan layer can often impede drainage limiting root growth. Forest are often lacking from areas of poor drainage where excessive moisture restricts tree growth. Such marshes are prevalent in the western part of the tayga such as the vast Vasyugan's swamp area of Western Siberia.¹⁷⁸

Coniferous tree species have adapted to the very cold and harsh winters. Moisture loss during winter months when the soil water is frozen and thus unavailable is reduced by the closing of stomata in the thick needle like leaves. Their root system develops close to the surface taking advantage of the shallow soils characteristic of the boreal region. When moisture becomes available in the spring with the warming temperatures, the coniferous species (evergreen conifers, principally Pine and Spruce species) can begin the current years growth since leaves are retained over winter. In the more severe climatic regions of the tayga zone (in much of East Siberia and The Far East), Larch species (deciduous evergreen species) appear better able to withstand the temperature range in winter which drops to less than -30 ° C. in January and grows in summer when average July temperature is 13 ° C.¹⁷⁹

¹⁷⁸In fact, the Soviets have a well developed program to improve the productivity of forest land by reducing the moisture content of the soils. On average between 1980 and 1989 about 150 thousand hectares of forest land have been drained. Draining not only can make hitherto unproductive forest land productive, but can also increase the site class of forest land where low productivity is due to insufficient drainage. (Lesnoye khozaustvo SSSR, page 17, Lesnaya Entsiklopediya, Vol. II, page 172)

¹⁷⁹ Geography of the Soviet Union, Cole, J.P., page 69.

The Mixed Forest Zone

The mixed forest zone is primarily located in the European part of the USSR where conifers and deciduous species are both widely encountered. Mixed forest zone also emerges in the Soviet Far East in response to climate modified by proximity to maritime influences. The northern limit follows the boundary defined by at least four frost free months per year while the southern limit is about 40 centimeters of rain per year.¹⁸⁰

The mixed forest consist of a mosaic of stands of coniferous tree species (primarily pine) and deciduous tree species (primarily basswood, oak, elm, and maple). It is unusual to encounter both types of trees in the same area. The conifers prefer drier, more well drained soils which are less favoured for agriculture. Deciduous species, on the other hand, grow on the less sandy (less well drained) and more fertile soils. The deciduous tree species, which occupy the more fertile soils, have generally been cleared for agriculture.¹⁸¹

The Broad-leaved Deciduous Forest Zone

The broad-leaved deciduous zone occupies a narrow strip extending from the western Ukraine to the East Siberian border. It is immediately to the south of the Mixed Forest zone (located in the European part of the USSR) and immediately south of the Tayga zone in the Asian part of the USSR. Climatic conditions of moisture and temperature favour a longer growing season which provides sufficient time for deciduous species to prosper. Beech, oak, and ash predominate in the European part while birch and aspen predominate in the Asian part. Soils are similar to those in the Mixed forest zone with many of the more fertile soils cleared for agriculture. Since land in this zone is sufficiently fertile to support agriculture, the forest resource is not large.

Forest Steppe and Steppe

As the climate becomes drier and warmer, the deciduous forests gradually fade away and are replaced by a transitional belt of forest steppe and then by steppe or prairie grassland. Much of the land in this zone, because it is so fertile, has been placed under

¹⁸⁰ Geography of the Soviet Union, Cole, J.P., page 69.

¹⁸¹ The Cambridge Encyclopedia of Russia and The Soviet Union, Brown, Archie *et alia* Editors, page 42.

agriculture. The forest steppe consists primarily of oak woodland distributed among grassland which has been heavily modified for agriculture. Forest resources of this zone are not large, and perform largely environmental protection roles, not industrial.

Semi-desert and Desert

Further south as the precipitation gradient decreases, the steppe is replaced by desert and semi-desert. The semi-desert and desert extends from a point just north of the Caspian Sea south and east to encompass much of Central Asia. Vegetation becomes less abundant and the soils consequently more erosion prone. Plant cover consists of grasses, herbs, and small shrubs. Thus, this is not an area of significant forest resources.

Mountain Zones

The mountain area of the USSR are generally located on land greater than one thousand meters in elevation.¹⁸³ This area is divided into three separate zones depending on vegetation association and variation of vegetation.

Mountain tayga and mountain tundra are mountain versions of tayga and tundra zones mentioned above. Not surprisingly, patches of tundra occur far from the Arctic in mountain regions where the elevation compensates for the warmer temperatures associated with a smaller latitude. Correspondingly, tayga forests also are located at lower latitudes than normally would be expected due to the more severe climatic conditions associated with land located at higher elevations. Mountain tayga forests, primarily located in East Siberia and the Far East, comprise a large share of the forest resources in these two regions, and thus is a significant contributor to the forest resources of the Soviet Union. Mountain tundra, of course, does not contain a forest resource of note.

Mountains located in the southern fringes of the USSR comprise the third category. These mountainous regions are characterized by a wide diversity of vegetation related to changes in temperature, moisture, gradient, and aspect. The diversity parallels the latitudinal variation which occurs from north to south described above.

¹⁸³Mountain zones should not be confused with mountain forests. While mountain zones will only contain mountain forests, mountain forests extend into vegetation zones other than mountain zones. Mountain forests do not have a rigid elevational boundary but focus more on relative differences in height.

While some forest resources are located in the mountain zone of the third category, primarily in the Caucasus, they are insignificant when compared to those located in the tayga and mountain tayga zones, which are mainly situated in East Siberia and The Far East regions, collectively called Pacific Asia of the Soviet Union.

APPENDIX B

RANGE OF MAJOR SPECIES GROWING IN THE SOVIET UNION

APPENDIX B

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APPENDIX B

RANGE OF MAJOR SPECIES GROWING IN THE SOVIET UNION

Overview

The tree species growing in the Soviet Union are grouped into three broad categories depending on whether the tree specie is a coniferous or a broad-leaved tree firstly, and then secondly, whether the wood density of the broad-leaved tree is greater than or less than 40 MPa. Tree species which have a wood density of less than 40 MPa are called softwood deciduous trees while trees with a wood density greater than 40 MPa are called hardwood deciduous trees.

The principal Coniferous species are larch, pine (containing two needles per fascicle sheath), spruce, cedar pine (pines with five needles per fascicle sheath) and true fir. The principal Hardwood Deciduous Tree Species are oak and beech. The principal Softwood deciduous species are birch, aspen, and basswood.

Coniferous

There are more than 55 geni and about 600 species within the coniferous classification which grow throughout the country. The principal geni are pines (*pinus* sp. - two needle), cedar pines (*pinus* sp. - five needle), spruce (*picea* sp.), true firs (*abies* sp.), and larch (*larix* sp.).

Pine

Pine species are distributed throughout the USSR. Twelve pine species grow naturally of which two are major. Scotch pine (*Pinus sylvestris*) has the most wide spread distribution, growing in European USSR, the Urals, the forest steppe up to between 700 and 1200 meters above sea level. It can grow up to 40 meters in height and to one meter in diameter. The second, Crimean pine (*Pinus pallasiana*), grows in the Crimean peninsula and in the Trans Caucasus up to elevations of 400 to 800 meters above sea level. It grows to 30 meters in height and up to 0.8 meters in diameter.

Figure B1 shows the distribution of the major two needle pine species of the Soviet Union.

Cedar Pine

There are four five needle pine species growing in the Soviet Union. **Figure B2** shows the distribution of the four principal species. With the exception of European cedar pine (*Pinus cembra*) which is located in an isolated part of the southwest part of the USSR, cedar pines are distributed from the Ural mountains in the west to Sakhalin Island in the east and as far north as the Arctic Circle from the Yakut ASSR to Magadan Oblast and Kamchatka Oblast. Siberian cedar (*Pinus sibirica*) is located in the north west part of European USSR, throughout West and East Siberia. In the mountainous regions, it grows up to the tree line at an elevation of between 1900 to 2400 meters above sea level. It grows up to 40 meters in height and up to 2 meters in diameter. Korean pine (*Pinus koraiensis*) grows mainly in the mountain regions of The Far East. The northern boundary is located at the shores of the Amur river and the Tatarsk Channel (between the Soviet mainland and Sakhalin Island). The western boundary lies along the shores of the Amur and Ussuri Rivers. It grows to between 30 and 60 meters with a diameter of up to 2 meters. The range of Creeping Cedar pine (*Pinus pumila*) in its natural environment grows in East Siberia and The Far East. It grows along the shoreline of the Okhot Sea on Sakhalin Island, in Kamchatka, on the Kuril Islands, in the Baikal Lake region and in Yakut ASSR. It grows in height to 5 meters. This particular variety of cedar pine is not considered a commercial species.

Spruce

The eleven species of spruce which grow in the USSR are distributed across the country, primarily in the tayga vegetation zone. Spruce also grows in the Caucasus mountains and in the Alma Alta mountains of Central Asia. Five of the Spruce species are important.

European spruce (*Picea abies*) is located in the the Baltic Republics, Belorussia, and the Carpat Mountains in the west to the middle reaches of the Kami river in the east and to the Pruyat basin in the south. It varies in height from 20 to 50 meters. Siberian spruce (*Picea obovata*) grows in the north, north east regions of the European part of USSR to the lower reaches of the Kami river. The largest portion grows in the Urals and Siberia. It grows in The Far East along the south Okhot shoreline and in the drainage area of the upper and lower Amur River. It grows in height up to 30 meters and to 0.8 meters and higher in diameter. Shrenka spruce (*Picea schrenkiana*) grows in the mountainous regions of Central Asia and Kazakhstan up to elevations of 3000 meters above sea level. It reaches heights of 45 meters and diameters of 2 meters.

Eastern spruce (*Picea orientalis*) grows in the western part of the Caucasus and in the Transcaucasus, at elevations between 1200 and 2500 meters above sea level. It reaches heights of 40 to 65 meters and diameters of up to 2 meters. Yezo spruce (*Picea ajanensis*) grows in The Far East, in Kamchatka and on Sakhalin Island. It attains heights of 50 meters and diameters of 0.5 meters. It is the most valuable species of the Far East. **Figure B3** shows the ranges of the major spruce species.

True Fir

Of the 50 species which belong to the *Abies* genus, 10 occur naturally in the Soviet Union. The main species include European Fir (*Abies alba*), Caucasian Fir (*Abies nordmanniana*), Siberian Fir (*Abies sibirica*), and Whitebark Fir (*Abies nephrolepis*). European or Silver Fir grows in mountainous areas of Western Soviet Union and western parts of the Caucasus. It reaches heights of 65 meters and diameters of 2 meters. Nordmann's or Caucasian Fir grows in the Caucasus Mountains at elevations exceeding 2000 meters. It reaches heights of 60 meters and diameters of 2 meters. Siberian Fir is one of the major species of trees in the USSR. It is distributed from the North West European part of the USSR through West and East Siberia. It attains heights of 30 meters and diameters of 1.5 meters. Whitebark or Amur Fir is a constant companion of Yezo Spruce in the Far East, but does not extend as far north. It reaches heights of 30 meters and diameters of one meter. **Figure B4** shows the distribution of the principal four abies species.

Larch

Larch is one of the most important species of the USSR, occupying nearly 40 percent of the forest land area. Of the 20 varieties, 7 grow naturally in the Soviet Union - three are considered important. Sukachev Larch (*Larix sukaczewii*), sometimes considered a variety of Siberian Larch, grows in the north-west part of European USSR, in Urals, and sometimes extending into Asian USSR. It reaches heights of 35 to 45 meters and diameters of up to 1.8 meters. Siberian Larch (*Larix sibirica*) grows in the West Siberian Plain, the Central Siberian Plateau, in the mountains of Southern Siberia. It reached heights of 45 meters and diameters of 1.8 meters. Gmelina Larch (*Larix gmelinii*) grows across a wide area in East Siberia and The Far East, growing as far north as the Arctic Tundra, reaching the coastline north of Sakhalin Island. It reaches heights of 35 to 40 meters and diameters of up to 1.5 meters. **Figure B5** shows the ranges of the three principal larix sp.

Hardwood deciduous species

Oak

About 19 different species of oak grow in the Soviet Union, located primarily in the mixed forest and deciduous tree zones. Three of them are considered important. Russian Oak (*Quercus robur*) is located in the European part of the USSR (excluding the Northwest, North and Uralian Regions), in the Crimea and in the Caucasus. It grows to 50 meters in height and up to 1 to 1.5 meters in diameter. European Oak (*Quercus petraea*) grows in the western regions of the Baltic Republics, Moldavia, and in the Caucasus reaching heights of 50 meters and diameters of 1 meter. Mongolian Oak (*Quercus mongolica*) grows naturally in East Siberia and The Far East within the Mixed forest zone. It can reach heights of 28 meters and diameters of up to one meter. **Figure B6** shows the distribution of Oak sp. in the USSR.

Beech

Beech (*Fagus* sp.) grow naturally in the Caucasus, the western part of the Ukraine, and in the Crimean Mountains up to elevations of 2000 meters above sea level. It can reach heights of between 45 and 50 meters and diameters of up to 2 meters. Ten species grow in the USSR, but only two are considered important.

European or Forest Beech (*Fagus sylvatica*) grows in the western region of the Ukraine, in the mountains of Crimea and in Moldavia, in western Belorussian. It reaches heights of 40 meters and diameters of 2 meters. Eastern Beech (*Fagus orientalis*) grows in the forests of the Caucasus and in Crimea. up to 2200 meters above sea level. It can grow up to 50 meters in height and 1.5 meters in diameter.

Figure B7 shows the distribution of the major types of beech in the USSR.

Softwood deciduous species

Birch

Birch species account for the most significant share of deciduous forest resource of the Soviet Union. It is distributed from the West Coast to the East Coast, extending as far north as the Arctic tundra and as far south as the forest steppe and steppe where it occurs in bush form. It occurs in the mountain regions of the Caucasus mountains and the Central Asia. Of the 100 species which grow naturally, two are considered important. Silver Birch (*Betula pendula*) grows throughout the Soviet Union, from coast to coast. It reaches 35 meters in height and up to 1 meter in diameter. Karelian

or Flame Birch (*Betula pubescens*) has a slightly more limited distribution, extending only as far east as Yakut ASSR and just beyond Lake Baikal. It is rarely present in the Caucasus and the mountains of Central Asia. **Figure B8** shows the range of these two species of birch.

Popular

About 50 *Populus* sp. grow in the Soviet Union; but one dwarfs the others both in range and presence. Aspen (*Populus tremula*) grows throughout the country, as far north as the polar tundra and as far south as the steppes where it occurs in brush form. It attains a height of 35 meters and diameters of up to 1 meter. **Figure B9** shows the distribution of Aspen in the Soviet Union.

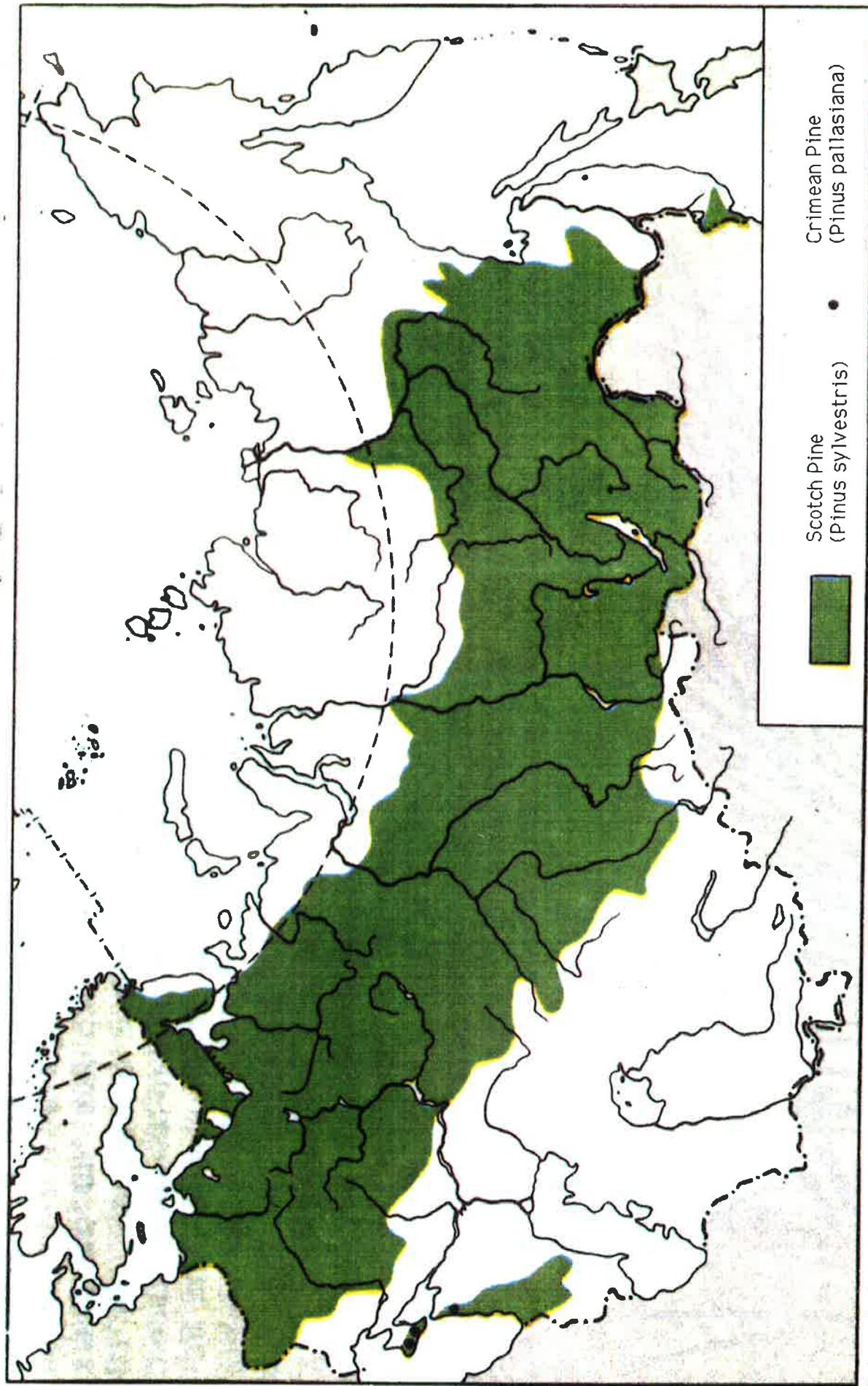
Basswood

Of the more than 50 species of basswood (*Tilia* sp.), 17 occur naturally in the Soviet Union. Heights of 30 meters and diameters of 2 meters are not uncommon. It is distributed throughout the European part of the country, in West Siberia and the Far East. Four species of *Tilia* sp. are considered important.

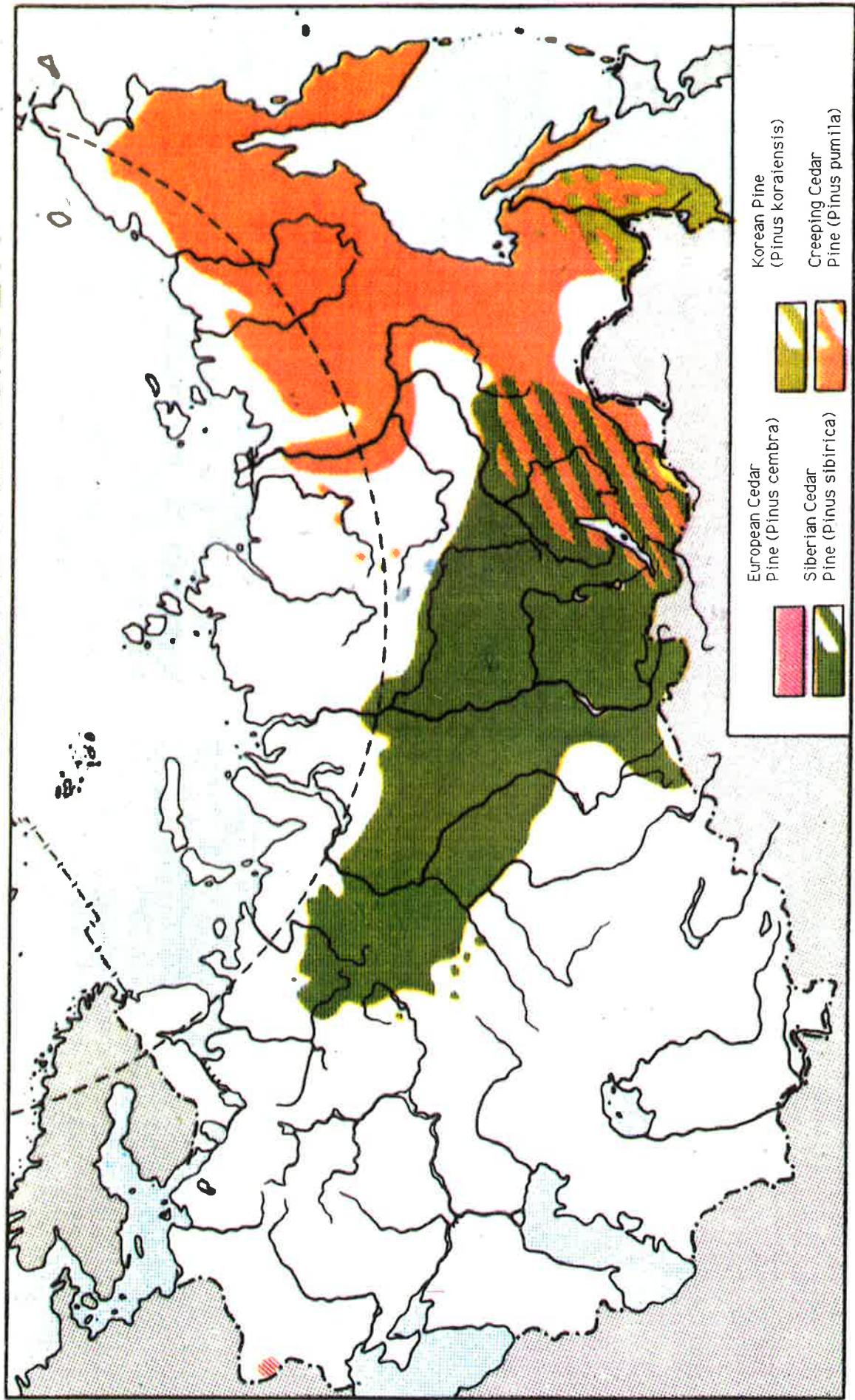
Small leafed basswood (*Tilia cordata*) grows in the European part of the country, from as far south as the Crimea to the northern boundary of the boreal forests. It occurs in Western Siberia, but rarely in the southern part. It reaches heights of 25 meters. Felt basswood (*Tilia tormentosa*) grows in the western reaches of the Ukraine and in Moldavia where it reaches heights of 30 meters. Siberian basswood (*Tilia sibirica*) grows in the foot hills of the Altay Mountains and as far east as Krasnoyarsk where it reaches heights of 27 meters. Amurk basswood (*Tilia amurensis*) grows in the Far East, along the Amur and Usseri Rivers and their tributaries. It reaches of heights of 15 meters.

Figure B10 shows the distribution of the major species of basswood.

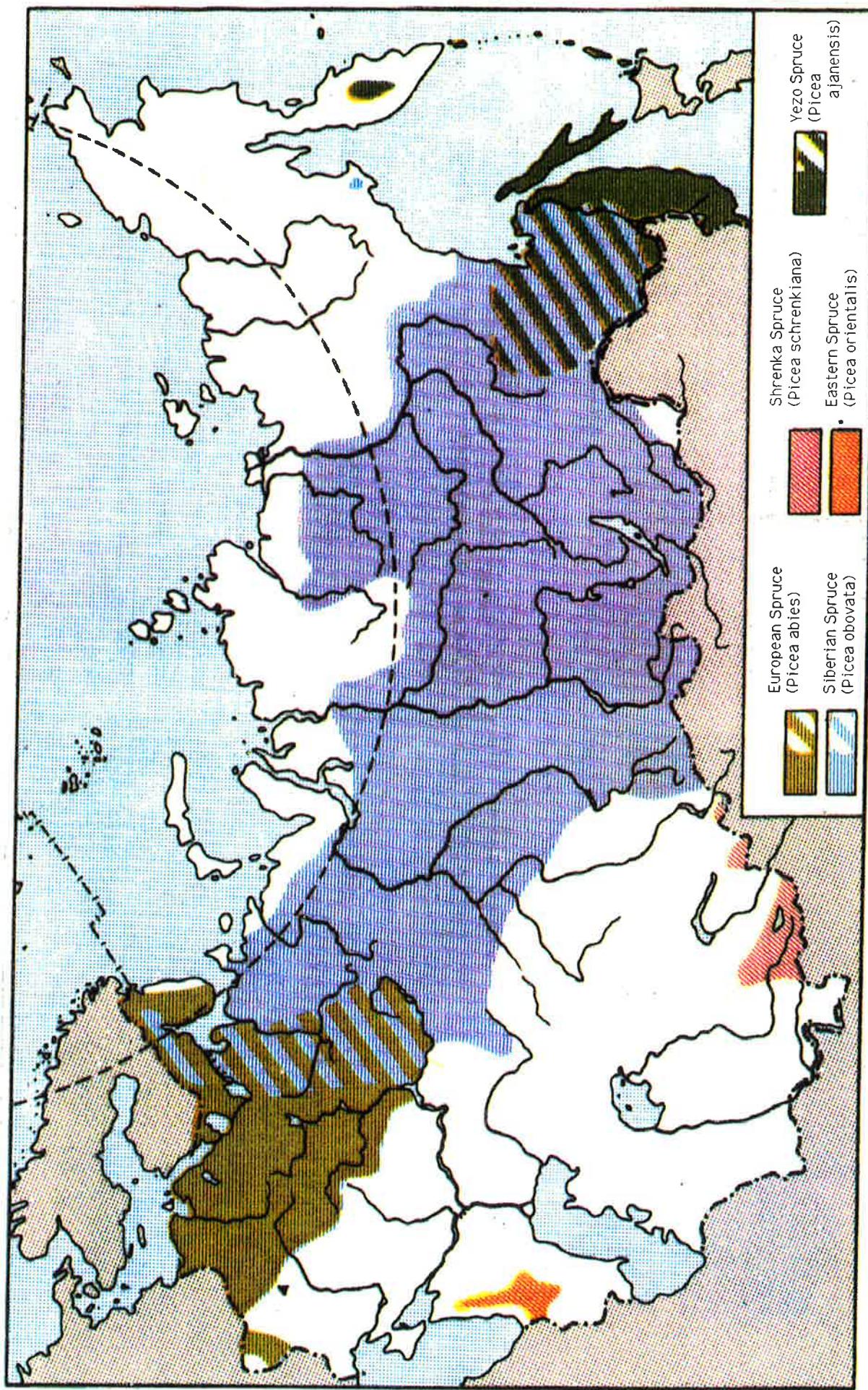
The Range of the Principal Pine Species of the Soviet Union



The Range of the Principal Cedar Pine Species of the Soviet Union



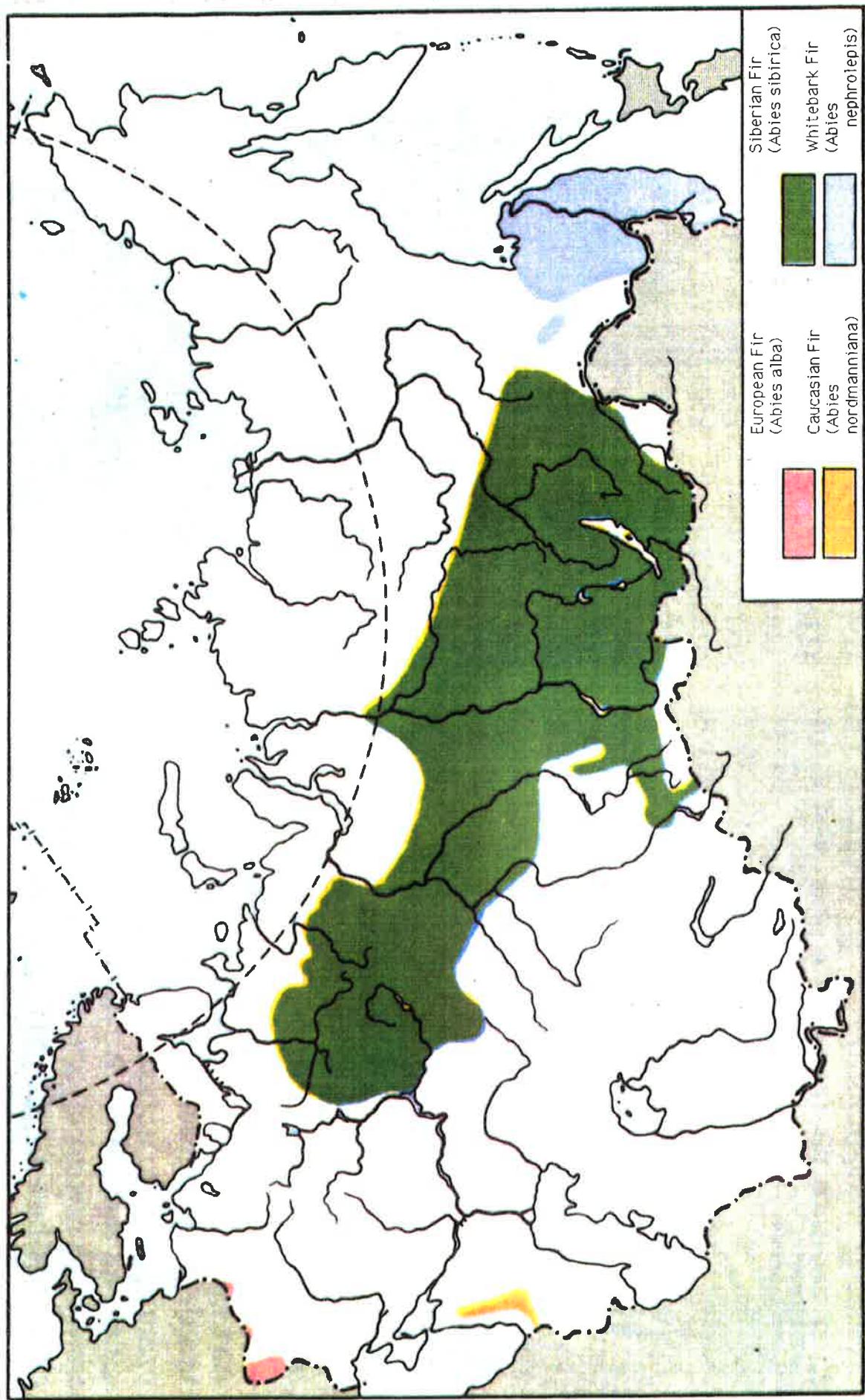
The Range of the Principal Spruce Species of the Soviet Union



Source: The Forest Encyclopedia of the Soviet Union/cab

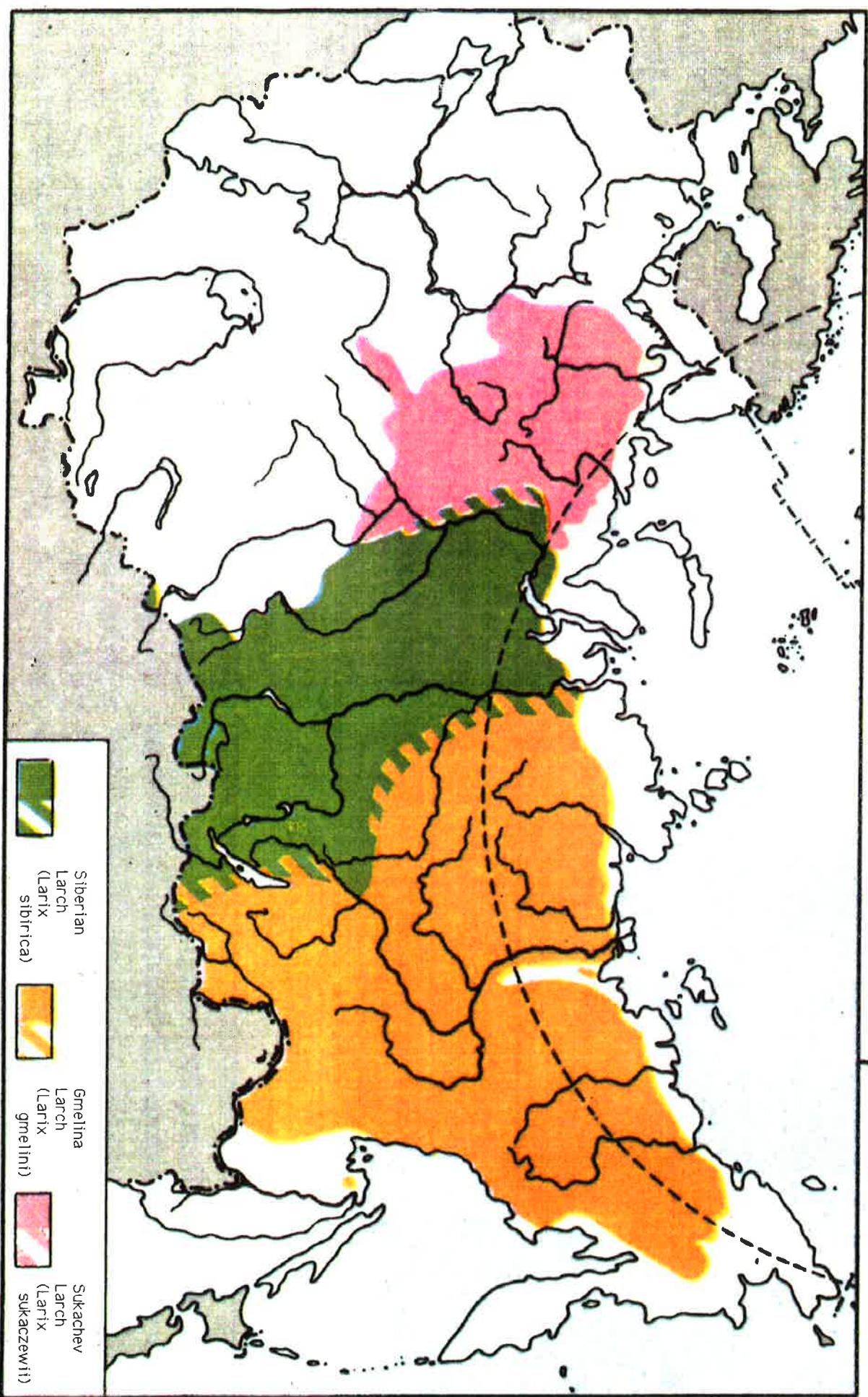
Figure B3

The Range of the Principal True Fir Species of the Soviet Union



The Range of the Principal Larch Species of the Soviet Union

193



Source: The Forest Encyclopedia of the Soviet Union/cab

Figure B5

The Range of the Principal Oak Species of the Soviet Union

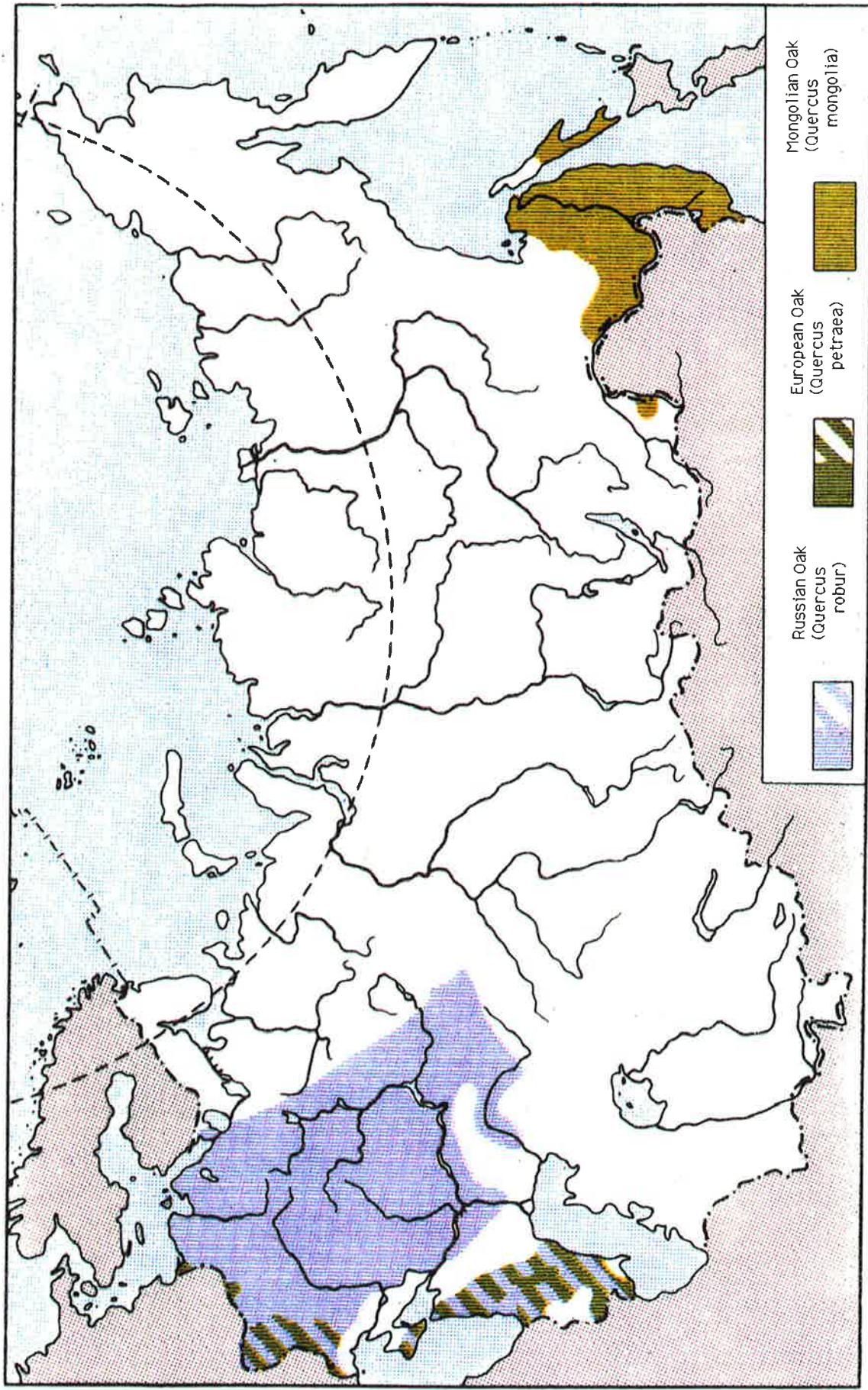
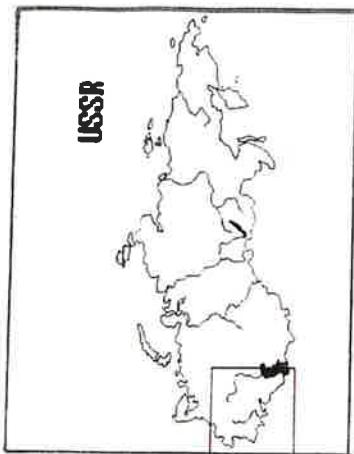
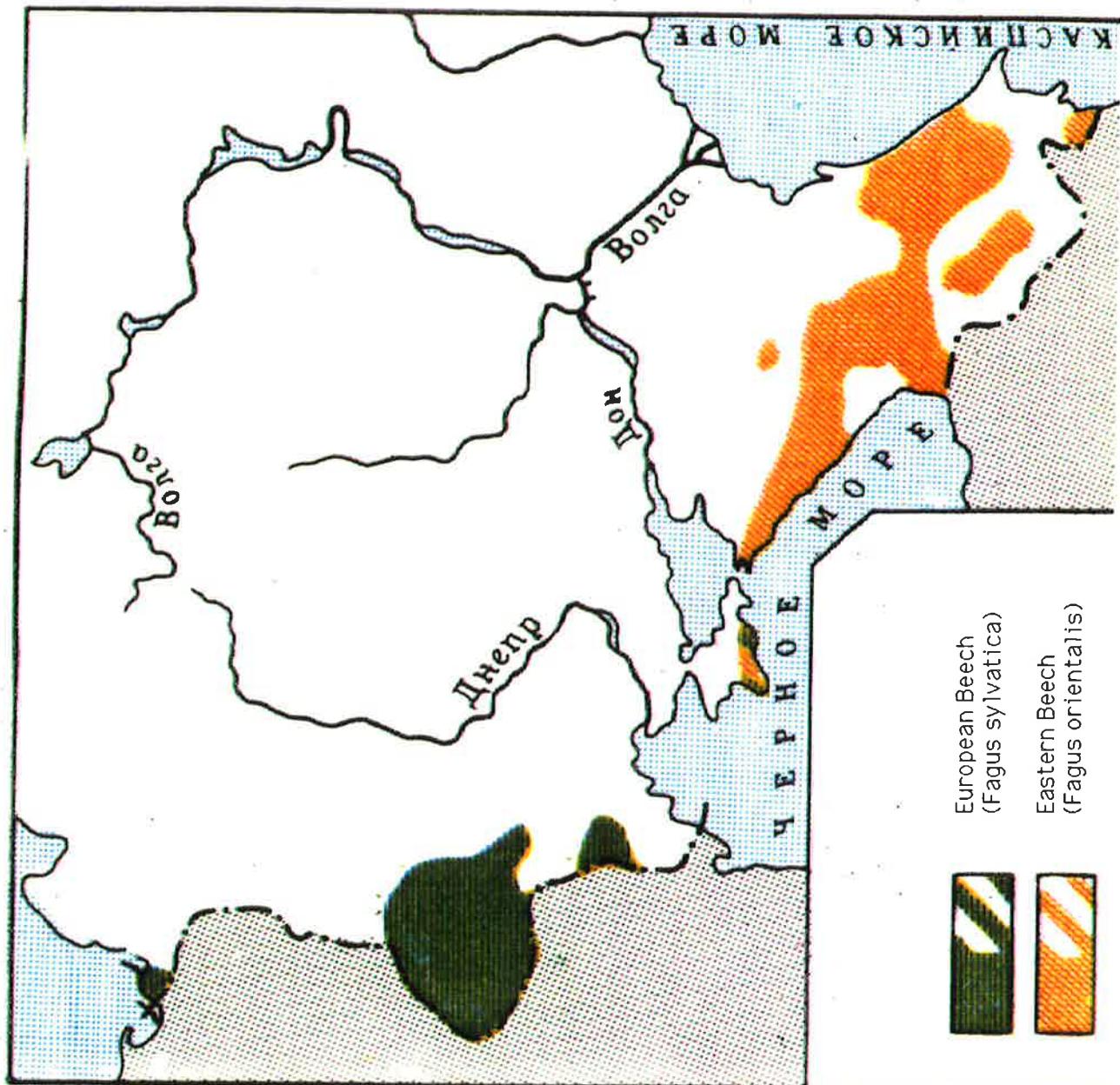


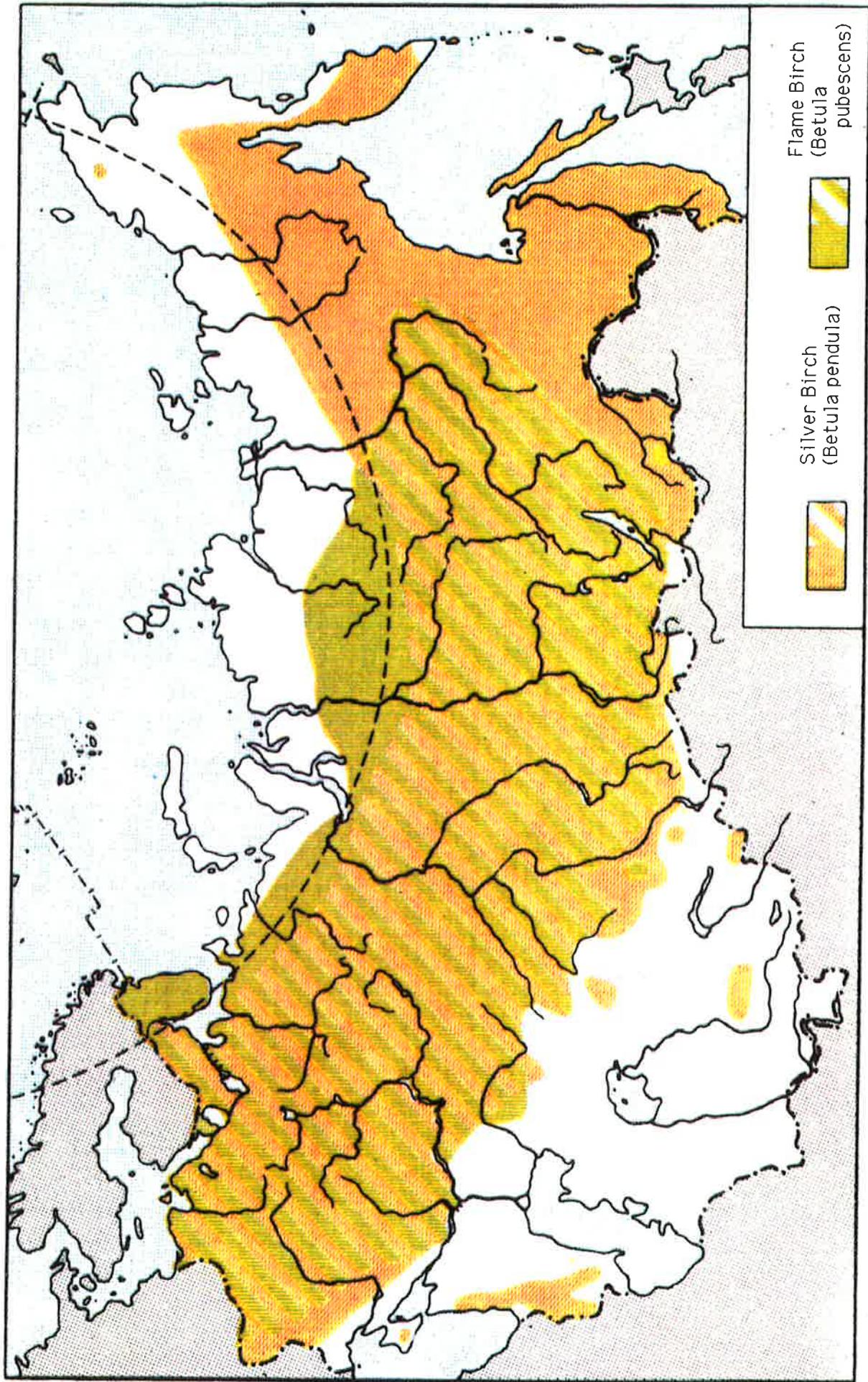
Figure B6

Source: The Forest Encyclopedia of the Soviet Union/cab

The Range of the Principal Beech Species of the Soviet Union



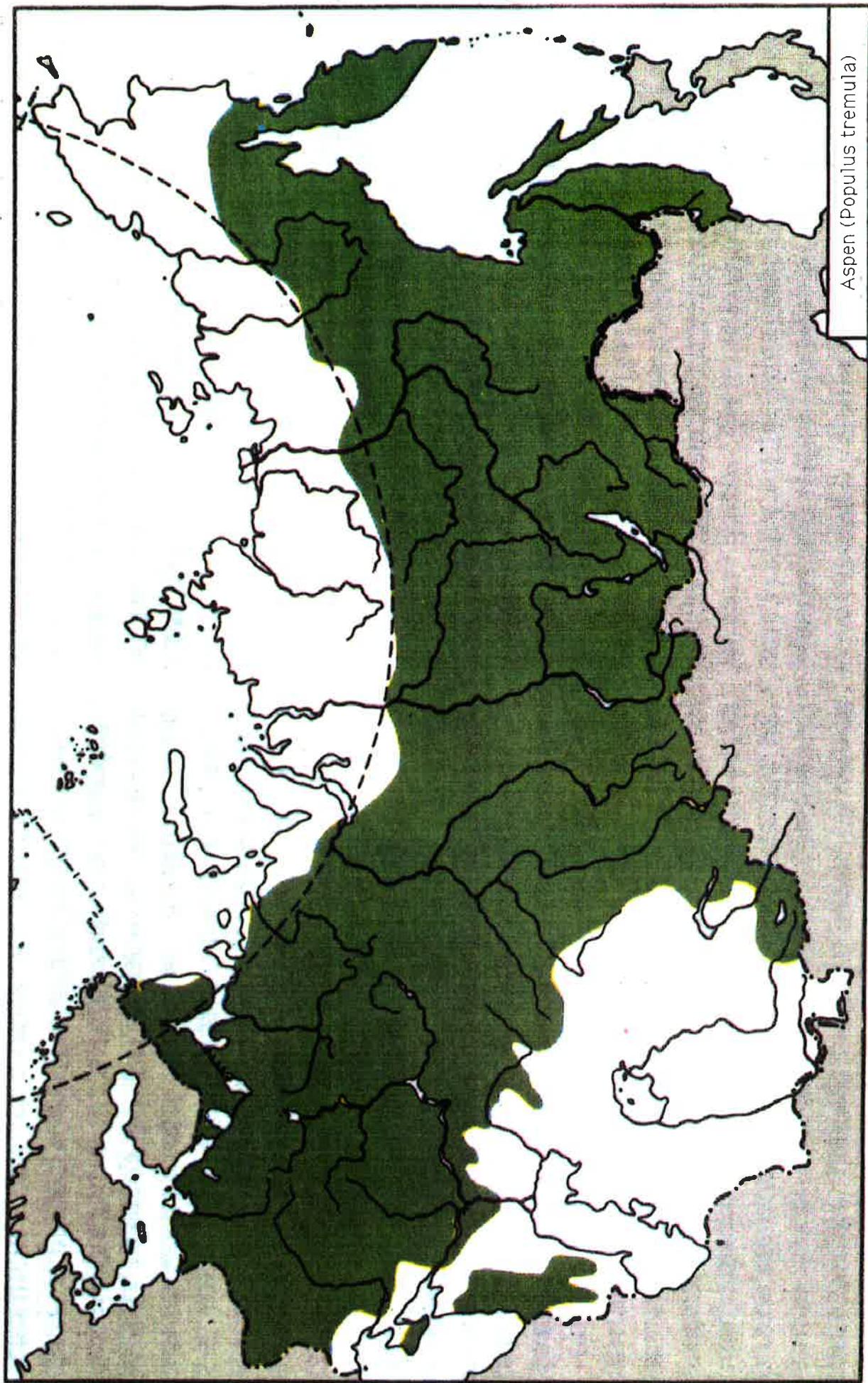
The Range of the Principal Birch Species of the Soviet Union



Source: The Forest Encyclopedia of the Soviet Union/cab

Figure B8

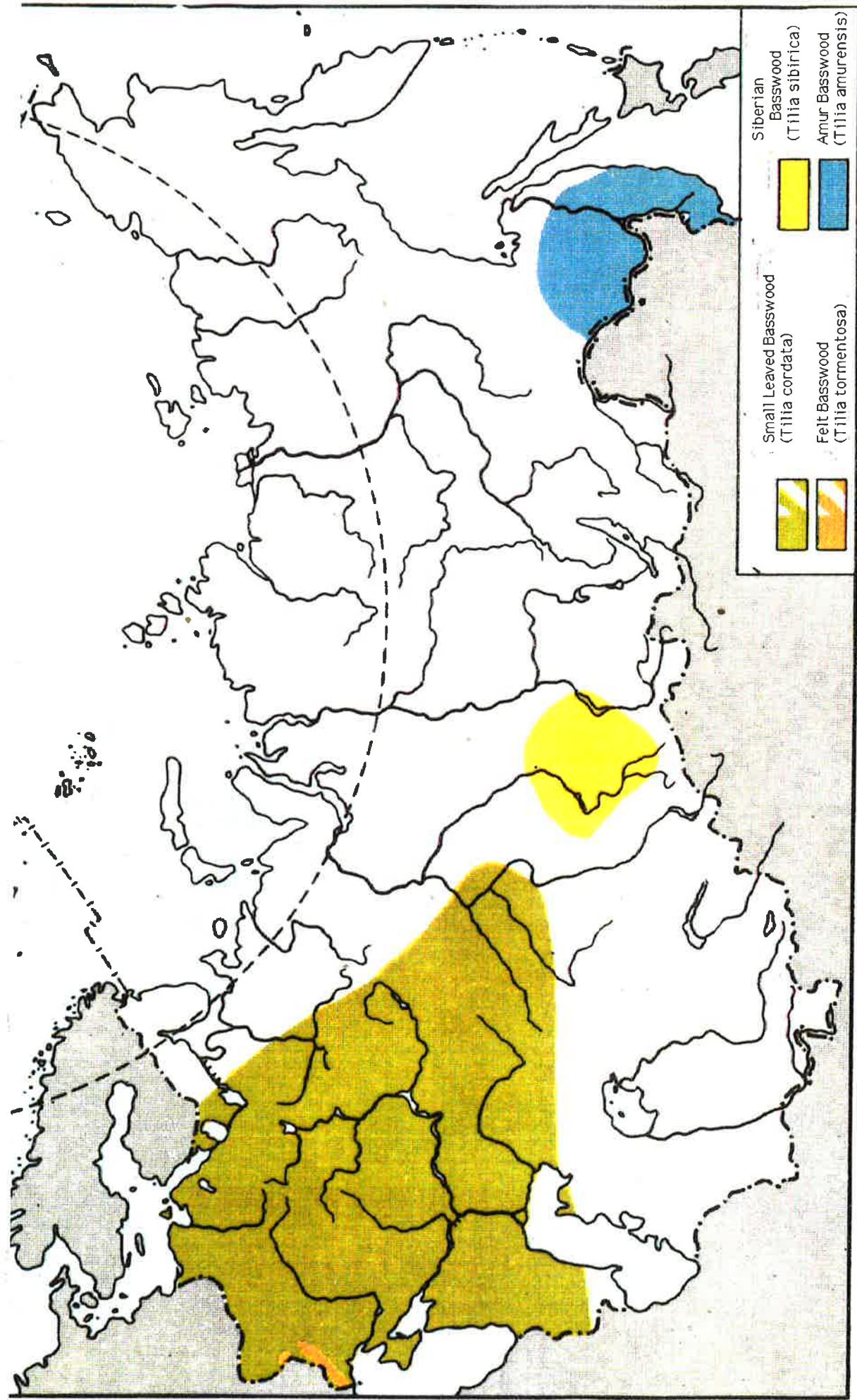
The Range of the Principal Aspen Species of the Soviet Union



Source: The Forest Encyclopedia of the Soviet Union/cat

Figure B9

The Range of the Principal Basswood Species of the Soviet Union



APPENDIX C

Forest Resource and Selected Industrial Statistics

APPENDIX C

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TABLE C1

Distribution of the Forest Land Resource Among the Principal Global Regions							
				(millions of hectares)			
World	USSR	Europe	North America	Latin America	Africa	Asia	Australia & Oceania
1980	1983	1983 (except USSR)	1977	1980	1980	1976 (except USSR)	1976
Total Land Area	13,033.0	2,144.0	468.0	1,875.0	2,031.0	2,970.0	2,703.0
Forest Land	4,136.2	938.0	175.0	620.0	939.5	751.2	522.1
Stocked Forest Land	2,985.6	810.9	145.2	583.0	690.5	223.0	451.2
coniferous	1,082.4	560.0	86.0	306.0	26.3	3.8	87.8
deciduous	1,903.2	250.9	59.2	277.0	664.2	219.2	363.4
Unstocked Forest Land	1,150.6	127.1	29.8	37.0	249.0	528.2	70.9
Degradated Land	408.5	0.0	0.0	0.0	169.2	166.0	73.3
Brush	624.2	0.0	0.0	0.0	145.9	442.8	35.5

Source: Soviet Forests at the Crossroads

TABLE C2

Distribution of the Growing Stock Among the Principal Global Regions							
				(billions of cubic meters)			
World	USSR	Europe	North America	Africa	Asia	Australia & Oceania	
1980	1983	1983	1983	1980	1980	1976	1976
		(except USSR)	1977	1980		(except USSR)	
Total Volume	356.7	85.9	14.9	41.7	102.9	50.2	54.4
of which in stocked forest	338.8	85.9	14.9	41.7	93.3	45	51.5
Volume of coniferous forests	116.9	66.7	10	29.6	2	0.1	8.04
of which in tropical forests	3.2	0	0	0	1.85	0.1	1.7
Volume in deciduous forests	239.8	19.2	4.9	12.1	100.9	50.1	46.36
of which in tropical forests	191.1	0	0	0	97.4	49.6	41.7
Annual Growth of Wood	3,217.0	906	460	851	230	100	630
Annual Harvest	3,020.3	356	334.3	483.6	362.4	433.9	1017.1
Source: Soviet Forests at the Crossroads							

TABLE C3

	SOVIET UNION: Stocked Forest Land - Distribution				
	Among Agencies With Administrative Responsibilities				
	By Species Group				
	(thousands of hectares)				
	Total				
	Stocked Forest Land	Coniferous	Hardwood	Softwood	Other species
TOTAL IN THE FOREST FUND	814,252	567,479	37,035	144,612	65,126
Collective Farms	18,938	7,537	1,601	9,801	0
Government Significant Forests	795,314	559,942	35,435	134,812	65,126
GOV. SIGNIFICANT FORESTS	795,314	559,942	35,435	134,812	65,126
Forest Ministry Forests	726,504	520,920	31,910	109,991	63,682
Forests set aside for other Organizations	68,810	39,022	3,524	24,820	1,444
FOREST MINISTRY FORESTS	726,504	520,920	31,910	109,991	63,682
Forests for longterm uses	45,933	20,374	9,146	2,279	14,134
Ministry Forests excluding those for longterm uses	680,571	500,546	22,764	107,712	49,548
OTHER MINISTRY FORESTS	68,810	39,022	3,524	24,820	1,444
Government Farm Forests	28,793	10,440	1,730	16,622	0
Forest Industry Forests	23,125	17,795	610	4,711	9
Other Ministries	16,893	10,786	1,184	3,488	1,435
FARM FORESTS	47,730	17,977	3,331	26,422	0
Collective Farm Forests	18,938	7,537	1,601	9,801	0
Government Farm Forests	28,793	10,440	1,730	16,622	0
FORESTS AVAILABLE FOR USE BY FOREST INDUSTRY	703,696	518,341	23,374	112,423	49,557
Ministry Forests excluding those for longterm uses	680,571	500,546	22,764	107,712	49,548
Forest Industry Forests	23,125	17,795	610	4,711	9

Source: USSR State Committee on Forests/cab

TABLE C4

	SOVIET UNION: Growing Stock - Distribution Among Agencies With Administrative Responsibilities				
	By Species Group				
	(millions of cubic meters)				
	Total	Coniferous	Hardwood	Softwood	Other
	Volume in Forest Fund		Deciduous	Deciduous	Species
SOVIET UNION:					
TOTAL IN THE FOREST FUND	85,919	66,420	3,057	15,022	1,419
Collective Farms	2,224	1,124	121	979	0
Government Significant Forests	83,695	65,297	2,936	14,043	1,419
GOV. SIGNIFICANT FORESTS	83,695	65,297	2,936	14,043	1,419
Forest Ministry Forests	74,881	59,533	2,578	11,400	1,370
Forests set aside for other Organizations	8,814	5,763	358	2,643	50
FOREST MINISTRY FORESTS	74,881	59,533	2,578	11,400	1,370
Forests for longterm uses	2,348	1,564	194	140	451
Ministry Forests excluding those for longterm uses	72,532	57,970	2,384	11,260	919
OTHER MINISTRY FORESTS	8,814	5,763	358	2,643	50
Government Farm Forests	3,396	1,595	93	1,708	0
Forest Industry Forests	3,277	2,599	133	545	0
Other Ministries	2,141	1,570	132	390	49
FARM FORESTS	5,620	2,719	214	2,688	0
Collective Farm Forests	2,224	1,124	121	979	0
Government Farm Forests	3,396	1,595	93	1,708	0
FORESTS AVAILABLE FOR USE BY FOREST INDUSTRY	75,809	60,568	2,517	11,805	919
Ministry Forests excluding those for longterm uses	72,532	57,970	2,384	11,260	919
Forest Industry Forests	3,277	2,599	133	545	0

Source: USSR State Committee on Forestry/cab

TABLE C5

SOVIET UNION: Forest Land - Distribution Under Control Of Forest Authorities (excluding forests allocated to long-term uses) To Groups I, II, and III Forests					
	(thousands of hectares)				
	Total	Stocked Forest Land	Unstocked Forest Land	Plantations Crown not Closed	Plantations Nurseries Other
SOVIET UNION:					
Group 1 Forests	142,186	127,234	13,658	1,224	70
Group 2 Forests	61,787	58,280	1,920	1,566	21
Group 3 Forests	603,273	518,159	83,218	1,894	3
of which:					
Special Zoned Forests	6,561	4,727	1,830	5	0
Reserve Forests	218,151	179,429	38,715	7	0
Operational Forests	378,561	334,004	42,673	1,882	3
Total Area of Group 1, 2, and 3					
Forests	807,246	703,673	98,795	4,684	94
<i>Percent of column:</i>					
Group 1 Forests	18%	18%	14%	26%	75%
Group 2 Forests	8%	8%	2%	33%	23%
Group 3 Forests	75%	74%	84%	40%	3%
of which:					
Special Zoned Forests	1%	1%	2%	0%	0%
Reserve Forests	27%	25%	39%	0%	0%
Operational Forests	47%	47%	43%	40%	3%
Total Area of Group 1, 2, and 3					
Forests	100%	100%	100%	100%	100%
<i>Percent of row:</i>					
Group 1 Forests	100%	89%	10%	1%	0%
Group 2 Forests	100%	94%	3%	3%	0%
Group 3 Forests	100%	86%	14%	0%	0%
of which:					
Special Zoned Forests	100%	72%	28%	0%	0%
Reserve Forests	100%	82%	18%	0%	0%
Operational Forests	100%	88%	11%	0%	0%
Total Area of Group 1, 2, and 3					
Forests	100%	87%	12%	1%	0%

Source: USSR State Committee on Forestry/cab

TABLE C6

SOVIET UNION: Unstocked Forest Land - Distribution Under Control Of Forest Authorities (excluding forests allocated to long-term uses) To Groups I, II, and III Forests					
(thousands of hectares)					
	Total	Unstocked	Glades	Burned/killed	Cutover
Soviet Union:					Open or Wasteland
Group 1 Forests	13,658	7,953		2,370	746
Group 2 Forests	1,920	254		302	1,120
Group 3 Forests	83,218	49,373		23,940	6,923
of which:					
Special Zoned Forests	1,830	1,357		431	14
Reserve Forests	38,715	26,808		10,843	164
Operational Forests	42,673	21,209		12,667	6,746
Total Area of Group 1, 2, and 3					
Forests	98,795	57,580		26,612	8,789
					5,814
Percent of column:					
Group 1 Forests	14%	14%		9%	8%
Group 2 Forests	2%	0%		1%	13%
Group 3 Forests	84%	86%		90%	79%
of which:					
Special Zoned Forests	2%	2%		2%	0%
Reserve Forests	39%	47%		41%	2%
Operational Forests	43%	37%		48%	77%
Total Area of Group 1, 2, and 3					
Forests	100%	100%		100%	100%
Percent of row:					
Group 1 Forests	100%	58%		17%	5%
Group 2 Forests	100%	13%		16%	58%
Group 3 Forests	100%	59%		29%	8%
of which:					
Special Zoned Forests	100%	74%		24%	1%
Reserve Forests	100%	69%		28%	0%
Operational Forests	100%	50%		30%	16%
Total Area of Group 1, 2, and 3					
Forests	100%	58%		27%	9%
					6%

Source: USSR State Committee on Forestry/cab

TABLE C7

SOVIET UNION: Group I Forests - Distribution Of Stocked Forest Land In Forests						
Under Control Of Forest Authorities (excluding forests allocated to long-term uses) by Major Species Group, Species, and Age Class						
				(thousands of hectares)		
					Age Class	
Stocked						
Forest	Young class I	Young class II	Middle Aged	Approaching	Mature &	
Land				Mature	Overmature	
Principle Forest Species						
Coniferous Species						
Pine	23,326	2,742	4,128	8,314	2,349	5,793
Spruce	15,208	698	510	2,411	1,560	10,029
True Firs	2,438	52	77	830	482	998
Larch	33,972	1,556	1,314	5,764	2,580	22,758
Korean Pine	9,968	349	685	4,813	1,992	2,129
Juniper	332	3	36	162	41	90
Total Coniferous Species	85,244	5,400	6,750	22,294	9,004	41,796
Hardwood Deciduous Species						
High stump Oak	2,993	351	632	1,423	262	326
Low stump Oak	2,437	83	157	1,408	394	395
Beech	2,126	14	76	1,078	331	628
Hornbeam	617	3	14	338	92	169
Ash	387	45	57	147	49	88
Maple	159	14	17	61	16	52
Elm	348	64	77	103	24	80
Stone Birch	1,160	34	81	168	113	764
Saksaul	2,442	178	155	1,097	716	298
White Acasia	238	22	34	120	32	29
Total Hardwood Deciduous	12,907	809	1,300	5,942	2,029	2,829
Softwood Deciduous Species						
Birch	16,052	807	1,089	7,982	2,127	4,048
Aspen	3,439	291	271	881	566	1,429
Gray Alder	298	6	26	131	84	52
Black Alder	809	64	81	432	122	110
Lime Tree	732	35	44	401	89	165
Popular	770	36	52	206	99	377
Ivy	650	35	81	256	94	184
Total Softwood Deciduous	22,750	1,272	1,643	10,289	3,180	6,366
Total Main Forest Species	120,901	7,481	9,693	38,525	14,213	50,992
Other Tree Species	491	54	61	177	69	129
Brush	5,840	105	663	2,518	593	1,962
Total Species	127,232	7,640	10,416	41,220	14,875	53,082

Source: USSR State Committee on Forestry/cab

TABLE C8

SOVIET UNION: Group I Forests - Distribution Of Volume In Forests Under Control Of Forest Authorities (excluding forests allocated to long-term uses) by Major Species Group, Specie, and Age Class						
		(millions of cubic meters)				
		Age Class				
Standing	Volume	Young class I	Young class II	Middle Aged	Approaching	Mature & Mature Overmature
Principle Forest Species						
Coniferous Species						
Pine	3,547	74	422	1,540	475	1,036
Spruce	2,318	17	49	445	305	1,501
True Firs	506	1	5	148	100	252
Larch	2,825	14	53	502	274	1,981
Korean Pine	2,024	9	76	1,024	474	441
Juniper	7	0	1	3	1	2
Total Coniferous Species	11,227	116	606	3,663	1,629	5,213
Hardwood Deciduous Species						
High stump Oak	365	10	45	211	44	55
Low stump Oak	271	1	6	152	54	57
Beech	470	1	8	210	79	172
Hornbeam	84	0	1	40	14	29
Ash	43	1	4	16	8	14
Maple	11	0	1	4	1	6
Elm	23	1	2	6	2	12
Stone Birch	100	0	3	12	10	74
Saksaul	5	0	0	2	2	1
White Acasia	12	0	1	6	2	3
Total Hardwood Deciduous	1,385	14	73	659	216	423
Softwood Deciduous Species						
Birch	1,637	7	32	831	279	488
Aspen	529	4	16	109	94	306
Gray Alder	29	0	1	12	9	7
Black Alder	95	1	4	53	19	18
Lime Tree	123	1	3	69	18	33
Popular	102	0	3	22	14	64
Ivy	51	1	3	18	9	20
Total Softwood Deciduous	2,567	14	61	1,114	442	936
Total Main Forest Species	15,178	144	740	5,436	2,287	6,572
Other Tree Species	35	1	2	10	6	17
Brush	105	1	7	71	8	19
Total Species	15,319	145	749	5,516	2,300	6,608

Source: USSR State Committee on Forestry/cab

TABLE C9

SOVIET UNION: Group II Forests - Distribution Of Stocked Forest Land In Forests Under Control Of Forest Authorities (excluding forests allocated to long-term uses) by Major Species Group, Specie, and Age Class						
		(thousands of hectares)				
		Age Class				
Stocked		Young class I	Young class II	Middle Aged	Approaching	Mature & Overmature
Forest Land					Mature	Overmature
Principle Forest Species						
Coniferous Species						
Pine	18,877	4,792	4,547	4,904	2,127	2,507
Spruce	8,071	2,463	1,095	1,189	1,154	2,170
True Firs	867	71	78	243	186	289
Larch	4,217	338	403	1,114	579	1,782
Korean Pine	814	118	73	324	178	121
Juniper						
Total Coniferous Species	32,846	7,782	6,196	7,775	4,224	6,869
Hardwood Deciduous Species						
High stump Oak	1,570	305	380	502	142	240
Low stump Oak	900	137	73	335	152	204
Beech	539	44	108	200	63	124
Hornbeam	113	1	8	58	21	24
Ash	148	22	27	40	26	33
Maple	48	8	6	10	3	22
Elm	26	4	5	12	2	4
Stone Birch	264	33	81	87	13	51
Saksaul						
White Acasia	3	0	0	1	1	1
Total Hardwood Deciduous	3,610	554	687	1,245	422	703
Softwood Deciduous Species						
Birch	14,288	1,600	1,796	6,692	1,900	2,301
Aspen	4,325	702	703	969	623	1,328
Gray Alder	281	13	33	93	79	62
Black Alder	823	98	115	396	118	95
Lime Tree	1,219	135	171	627	92	195
Popular	14	1	1	6	3	3
Ivy	20	4	3	7	3	4
Total Softwood Deciduous	20,969	2,552	2,822	8,790	2,817	3,988
Total Main Forest Species	57,426	10,888	9,705	17,809	7,463	11,560
Other Tree Species	31	11	5	7	2	7
Brush	824	119	179	369	24	133
Total Species	58,280	11,018	9,889	18,185	7,489	11,700

Source: USSR State Committee on Forestry/cab

TABLE C10

SOVIET UNION: Group II Forests - Distribution Of Volume In Forests Under Control Of Forest Authorities (excluding forests allocated to long-term uses) by Major Species Group, Species, and Age Class						
		(millions of cubic meters)				
		Age Class				
Standing Volume		Young class I	Young class II	Middle Aged	Approaching Mature	Mature & Overmature
Principle Forest Species						
Coniferous Species						
Pine	2,420	124	488	877	454	477
Spruce	1,196	61	104	230	290	511
True Firs	157	1	7	43	40	65
Larch	532	6	23	137	83	283
Korean Pine	141	3	8	64	39	26
Juniper						
Total Coniferous Species	4,446	196	629	1,351	906	1,362
Hardwood Deciduous Species						
High stump Oak	208	10	36	90	28	43
Low stump Oak	96	2	3	37	22	32
Beech	122	2	16	49	18	37
Hornbeam	17	0	1	8	4	5
Ash	20	1	3	6	5	6
Maple	5	0	0	1	0	3
Elm	2	0	0	1	0	1
Stone Birch	16	1	3	6	1	6
Saksaul						
White Acasia	0		0	0	0	0
Total Hardwood Deciduous	487	16	62	199	78	132
Softwood Deciduous Species						
Birch	1,685	19	78	839	340	410
Aspen	596	11	48	123	110	305
Gray Alder	31	0	2	9	10	10
Black Alder	102	1	6	55	22	18
Lime Tree	171	2	10	102	19	38
Popular	2		0	1	0	1
Ivy	1	0	0	0	0	0
Total Softwood Deciduous	2,589	34	143	1,129	502	780
Total Main Forest Species	7,521	246	835	2,679	1,487	2,274
Other Tree Species	3	0	0	1	0	2
Brush	14	0	2	9	1	2
Total Species	7,538	247	837	2,689	1,488	2,278

Source: USSR State Committee on Forestry/cab

TABLE C11

SOVIET UNION: Group III Forests - Distribution Of Stocked Forest Land In Forests Under Control Of Forest Authorities (excluding forests allocated to long-term uses) by Major Species Group, Specie, and Age Class						
			(thousands of hectares)			
	Stocked			Age Class		
	Forest	Young class I	Young class II	Middle Aged	Approaching	Mature &
	Land				Mature	Overmature
Principle Forest Species						
Coniferous Species						
Pine	76,172	9,575	6,339	14,779	7,773	37,707
Spruce	53,769	4,485	2,703	3,857	2,657	40,068
True Firs	13,038	901	654	1,665	1,555	8,263
Larch	228,743	18,847	18,045	46,634	17,594	127,623
Korean Pine	28,516	972	1,104	3,964	6,913	15,563
Juniper						
Total Coniferous Species	400,238	34,780	28,846	70,898	36,491	229,224
Hardwood Deciduous Species						
High stump Oak	1,293	41	111	397	206	537
Low stump Oak	454	44	41	105	62	202
Beech						
Hornbeam						
Ash	230	6	4	28	37	156
Maple	172	1	1	8	7	154
Elm	69	2	2	8	6	50
Stone Birch	4,636	121	142	355	383	3,636
Saksaul						
White Acasia						
Total Hardwood Deciduous	6,854	216	301	900	701	4,736
Softwood Deciduous Species						
Birch	56,579	6,341	6,748	17,247	6,094	20,149
Aspen	10,473	1,583	1,128	1,290	682	5,792
Gray Alder	145	8	20	44	48	26
Black Alder	151	8	24	88	15	16
Lime Tree	948	38	37	149	105	620
Popular	197	4	6	38	19	129
Ivy	201	8	31	94	34	35
Total Softwood Deciduous	68,695	7,989	7,992	18,950	6,997	26,767
Total Main Forest Species	475,787	42,984	37,139	90,748	44,189	260,726
Other Tree Species	31	5	8	6	2	10
Brush	42,341	884	5,160	20,346	4,916	11,036
Total Species	518,159	43,873	42,307	111,099	49,107	271,773

Source: USSR State Committee on Forestry/cab

TABLE C12

SOVIET UNION: Group III Forests - Distribution Of Volume In Forests Under Control Of Forest Authorities (excluding forests allocated to long-term uses) by Major Species Group, Species, and Age Class						
		(millions of cubic meters)				
		Age Class				
Standing	Volume	Young class I	Young class II	Middle Aged	Approaching	Mature & Overmature
Principle Forest Species						
Coniferous Species						
Pine	9,293	135	338	1,782	1,097	5,942
Spruce	7,363	47	89	454	430	6,343
True Firs	2,057	11	32	221	263	1,530
Larch	21,000	151	591	3,620	2,033	14,605
Korean Pine	5,180	20	116	745	1,294	3,004
Juniper						
Total Coniferous Species	44,894	363	1,166	6,823	5,118	31,424
Hardwood Deciduous Species						
High stump Oak	124	1	5	33	21	64
Low stump Oak	38	1	2	8	6	21
Beech						
Hornbeam						
Ash	28	0	0	3	5	20
Maple	21	0	0	1	1	19
Elm	8	0	0	1	1	6
Stone Birch	426	1	6	25	31	362
Saksaul						
White Acasia						
Total Hardwood Deciduous	645	3	14	71	65	493
Softwood Deciduous Species						
Birch	4,908	47	164	1,249	664	2,784
Aspen	1,540	17	45	114	96	1,268
Gray Alder	10	0	1	2	4	3
Black Alder	7	0	1	4	1	2
Lime Tree	138	1	2	21	16	99
Popular	31	0	0	4	3	24
Ivy	13	0	1	5	3	5
Total Softwood Deciduous	6,648	66	213	1,398	786	4,184
Total Main Forest Species	52,187	432	1,393	8,292	5,969	36,102
Other Tree Species	1	0	0	0	0	1
Brush	760	4	46	477	72	161
Total Species	52,949	436	1,439	8,769	6,041	36,263

Source: USSR State Committee on Forestry/cab

TABLE C13

SOVIET UNION: Groups I, II, and III Forests Combined - Distribution Of Stocked Forest Land Under Control Of Forest Authorities (excluding forests allocated to long-term uses) by Major Species Group, Species, and Age Class						
				(thousands of hectares)		
				Age Class		
Stocked						
	Forest Land	Young class I	Young class II	Middle Aged	Approaching Mature	Mature & Overmature
Principle Forest Species						
Coniferous Species						
Pine	118,375	17,109	15,015	27,996	12,249	46,006
Spruce	77,048	7,646	4,308	7,457	5,371	52,266
True Firs	16,343	1,024	808	2,738	2,223	9,550
Larch	266,931	20,741	19,763	53,511	20,754	152,163
Korean Pine	39,299	1,440	1,862	9,101	9,083	17,814
Juniper	332	3	36	162	41	90
Total Coniferous Species	518,329	47,962	41,791	100,966	49,720	277,889
Hardwood Deciduous Species						
High stump Oak	5,855	697	1,122	2,322	610	1,103
Low stump Oak	3,791	264	272	1,847	607	801
Beech	2,666	59	184	1,278	394	752
Hornbeam	729	4	22	396	113	194
Ash	765	73	87	214	113	277
Maple	379	22	23	79	26	228
Elm	443	70	85	123	32	135
Stone Birch	6,060	188	304	609	509	4,451
Saksaul	2,444	178	155	1,097	716	298
White Acasia	241	23	34	122	33	30
Total Hardwood Deciduous	23,373	1,578	2,288	8,087	3,151	8,268
Softwood Deciduous Species						
Birch	86,920	8,747	9,633	31,920	10,121	26,498
Aspen	18,237	2,576	2,102	3,140	1,870	8,549
Gray Alder	725	26	79	269	211	141
Black Alder	1,782	169	220	917	256	221
Lime Tree	2,899	207	251	1,176	286	980
Popular	980	41	59	250	121	509
Ivy	872	47	115	356	131	223
Total Softwood Deciduous	112,414	11,813	12,457	38,029	12,995	37,121
Total Main Forest Species	654,116	61,354	56,537	147,082	65,866	323,278
Other Tree Species	552	70	74	190	73	146
Brush	49,005	1,107	6,002	23,232	5,533	13,131
Total Species	703,673	62,530	62,612	170,504	71,472	336,555

Source: USSR State Committee on Forestry/cab

TABLE C14

SOVIET UNION: Groups I, II, and III Forests Combined - Distribution Of Volume						
Under Control Of Forest Authorities (excluding forests allocated to long-term uses) by Major Species Group, Species, and Age Class						
(millions of cubic meters)						
Age Class						
Standing		Young class I	Young class II	Middle Aged	Approaching	Mature &
Volume					Mature	Overmature
Principle Forest Species						
Coniferous Species						
Pine	15,260	333	1,247	4,198	2,026	7,455
Spruce	10,877	125	242	1,130	1,025	8,355
True Firs	2,720	13	44	413	403	1,847
Larch	24,358	172	667	4,260	2,390	16,869
Korean Pine	7,344	32	201	1,833	1,807	3,471
Juniper	7	0	1	3	1	2
Total Coniferous Species	60,566	675	2,402	11,837	7,653	37,999
Hardwood Deciduous Species						
High stump Oak	698	21	87	335	94	162
Low stump Oak	404	3	11	197	82	110
Beech	592	3	24	259	97	209
Hornbeam	101	0	1	48	18	34
Ash	92	2	8	25	17	40
Maple	37	0	1	5	2	28
Elm	33	1	3	8	3	19
Stone Birch	542	3	13	43	42	442
Saksaul	5	0	0	2	2	1
White Acasia	12	0	1	6	2	3
Total Hardwood Deciduous	2,517	33	148	928	359	1,049
Softwood Deciduous Species						
Birch	8,230	74	273	2,918	1,283	3,681
Aspen	2,665	32	109	346	300	1,879
Gray Alder	70	0	4	23	24	19
Black Alder	205	2	11	112	42	38
Lime Tree	433	3	14	192	53	170
Popular	135	1	3	27	17	88
Ivy	65	1	4	24	11	25
Total Softwood Deciduous	11,803	114	418	3,641	1,730	5,900
Total Main Forest Species	74,887	822	2,968	16,406	9,742	44,948
Other Tree Species	40	1	2	11	6	20
Brush	879	5	55	558	81	181
Total Species	75,806	828	3,025	16,975	9,829	45,149

Source: USSR State Committee on Forestry/cab

TABLE C15

SOVIET UNION: Site Class - Distribution of Stocked Forest Land Administered By Forest Authorities (including that allocated to long-term uses) By Major Species Group (excluding species not included in one of the three species groups)						
						(thousands of hectares)
	Site Class 2 and higher	Site Class 3	Site Class 4	Site Class 5	Site Class Below 5	Total Stocked Forest Land
SOVIET UNION:						
Coniferous Species	35,891	127,663	136,367	152,251	86,544	538,715
Hardwood Deciduous Species	7,317	11,646	4,993	5,843	2,722	32,520
Softwood Deciduous Species	34,707	38,003	24,821	11,750	5,422	114,702
Total Area of Coniferous and Deciduous Species	77,914	177,311	166,181	169,843	94,689	685,938
<i>Percent of column:</i>						
Coniferous Species	46%	72%	82%	90%	91%	79%
Hardwood Deciduous Species	9%	7%	3%	3%	3%	5%
Softwood Deciduous Species	45%	21%	15%	7%	6%	17%
Total Area of Coniferous and Deciduous Species	100%	100%	100%	100%	100%	100%
<i>Percent of row:</i>						
Coniferous Species	7%	24%	25%	28%	16%	100%
Hardwood Deciduous Species	22%	36%	15%	18%	8%	100%
Softwood Deciduous Species	30%	33%	22%	10%	5%	100%
Total Area of Coniferous and Deciduous Species	11%	26%	24%	25%	14%	100%
Source: USSR State Committee on Forestry/cab						

TABLE C16

SOVIET UNION: Stocking Class - Distribution of Stocked Forest Land Administered By Forest Authorities (including that allocated to long-term uses) By Major Species Group (excluding species not included in one of the three species groups)				
(thousands of hectares)				
	Stocking Class	Stocking Class	Stocking Class	Total Stocked Forest Land
	good	medium	poor	
SOVIET UNION:				
Coniferous Species	68,274	312,627	157,813	538,715
Hardwood Deciduous Species	4,328	16,299	11,894	32,520
Softwood Deciduous Species	31,003	68,840	14,859	114,702
Total Area of Coniferous and Deciduous Species	103,606	397,766	184,566	685,938
<i>Percent of column:</i>				
Coniferous Species	66%	79%	86%	79%
Hardwood Deciduous Species	4%	4%	6%	5%
Softwood Deciduous Species	30%	17%	8%	17%
Total Area of Coniferous and Deciduous Species	100%	100%	100%	100%
<i>Percent of row:</i>				
Coniferous Species	13%	58%	29%	100%
Hardwood Deciduous Species	13%	50%	37%	100%
Softwood Deciduous Species	27%	60%	13%	100%
Total Area of Coniferous and Deciduous Species	15%	58%	27%	100%
Source: USSR State Committee on Forestry/cab				

TABLE C17

SOVIET UNION: Mountain Forests (excluding forests allocated for long-term uses) - Distribution of Stocked Forest Land By Group of Forest and By Principal Species Group						
						(thousands of hectares)
Total						
Stocked Forest						
Coniferous Land			Hardwood		Softwood	
Deciduous Species				Deciduous		Other
SOVIET UNION:						Brush Species
Group 1	46,917	28,903	6,440	7,412	379	3,783
Group 2	17,390	10,691	1,754	4,111	28	805
Group 3	208,270	145,943	6,602	22,179	31	33,515
Total Mountain Forests						
in Groups 1, 2, and 3 Forests	272,577	185,537	14,797	33,702	437	38,104
<i>Percent of column:</i>						
Group 1	17%	16%	44%	22%	87%	10%
Group 2	6%	6%	12%	12%	6%	2%
Group 3	76%	79%	45%	66%	7%	88%
Total Mountain Forests						
in Groups 1, 2, and 3 Forests	100%	100%	100%	100%	100%	100%
<i>Percent of row:</i>						
Group 1	100%	62%	14%	16%	1%	8%
Group 2	100%	61%	10%	24%	0%	5%
Group 3	100%	70%	3%	11%	0%	16%
Total Mountain Forests						
in Groups 1, 2, and 3 Forests	100%	68%	5%	12%	0%	14%

Source: USSR State Committee on Forestry/cab

TABLE C18

SOVIET UNION: Mountain Forests (excluding forests allocated to long-term uses) - Distribution of Growing Stock By Group of Forest and By Principal Species Group				
				(millions of cubic meters)
	Total			
	Growing Stock	Coniferous Species	Hardwood Deciduous	Softwood Deciduous
SOVIET UNION:				
Group 1	6,646	4,845	909	892
Group 2	2,035	1,405	240	390
Group 3	20,805	17,629	622	2,554
Total Mountain Forests				
in Groups 1, 2, and 3 Forests	29,485	23,879	1,771	3,836
<i>Percent of column:</i>				
Group 1	23%	20%	51%	23%
Group 2	7%	6%	14%	10%
Group 3	71%	74%	35%	67%
Total Mountain Forests				
in Groups 1, 2, and 3 Forests	100%	100%	100%	100%
<i>Percent of row:</i>				
Group 1	100%	73%	14%	13%
Group 2	100%	69%	12%	19%
Group 3	100%	85%	3%	12%
Total Mountain Forests				
in Groups 1, 2, and 3 Forests	100%	81%	6%	13%
Source: USSR State Committee on Forestry/cab				

TABLE C19

SOVIET UNION: Stocked Forest Land (excluding that allocated to long-term uses) - Distribution Under Control of Forest Authorities by Mountain and Non-mountain Category and by Species Group and by Age Class						
(thousands of hectares)						
Total Stocked Forest Land	Coniferous Species	Hardwood	Softwood	Other Species	Deciduous	Principle Three Species Groups
SOVIET UNION:						
Mountain Forests	272,577	185,537	14,797	33,702	38,541	234,036
Non-Mountain Forests	431,119	332,803	8,578	78,721	11,017	420,102
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	703,696	518,341	23,374	112,423	49,557	654,138
<i>Percent of column:</i>						
Mountain Forests	39%	36%	63%	30%	78%	36%
Non-Mountain Forests	61%	64%	37%	70%	22%	64%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	100%	100%	100%	100%	100%
<i>Percent of row:</i>						
Mountain Forests	100%	68%	5%	12%	14%	100%
Non-Mountain Forests	100%	77%	2%	18%	3%	100%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	74%	3%	16%	7%	100%
Source: USSR State Committee on Forestry/cab						

TABLE C20

SOVIET UNION: Growing Stock (excluding that allocated to long-term uses) - Distribution Under Control of Forest Authorities by Mountain and Non-mountain Category and by Species Group and by Age Class						
(millions of cubic meters)						
Total Growing Stock	Coniferous Species	Hardwood Species	Softwood Deciduous	Other Species	Groups	Principle Three Species
SOVIET UNION:					All Ages	Mature & Less than mature
Mountain Forests	29,485	23,879	1,771	3,836	0	29,485
Non-Mountain Forests	46,324	36,690	746	7,969	919	45,405
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	75,809	60,568	2,517	11,805	919	74,890
<i>Percent of column:</i>						
Mountain Forests	39%	39%	70%	32%	0%	39%
Non-Mountain Forests	61%	61%	30%	68%	100%	61%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	100%	100%	100%	100%	100%
<i>Percent of row:</i>						
Mountain Forests	100%	81%	6%	13%	0%	100%
Non-Mountain Forests	100%	79%	2%	17%	2%	100%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	80%	3%	16%	1%	100%

Source: USSR State Committee on Forestry/cab

TABLE C21

		SOVIET UNION: Allowable Annual Cut (from forests managed by the Forest Authorities) - Distribution by Forest Group, by Species Group, and by Year					
		(thousands of cubic meters)					
		Year					
		1980	1985	1986	1987	1988	1989
<i>Forest Groups:</i>							
Total		638,352	638,270	637,980	636,228	626,228	625,309
Group I		49,701	58,550	58,924	59,412	58,784	58,967
Group II		110,679	109,696	108,795	108,090	106,522	106,768
Group III		477,972	470,024	470,261	468,726	461,447	459,574
<i>Species Groups:</i>							
Total		638,352	638,270	637,980	636,228	626,228	625,309
Coniferous		404,567	400,187	400,574	400,131	392,996	392,576
Hardwood Deciduous		15,487	15,845	15,664	15,326	15,416	15,330
Softwood Deciduous		218,298	222,238	221,742	220,771	218,341	217,403
<i>Coniferous Species:</i>							
Total		404,567	400,187	400,574	400,131	392,996	392,576
Group I		21,907	28,788	29,221	30,147	30,091	30,362
Group II		49,447	47,317	47,283	47,078	45,888	45,984
Group III		333,213	324,082	324,070	322,906	317,017	316,230
<i>Hardwood Deciduous Species:</i>							
Total		15,487	15,845	15,664	15,326	15,416	15,330
Group I		3,242	3,620	3,575	3,522	3,738	3,748
Group II		5,929	5,788	5,652	5,627	5,541	5,445
Group III		6,316	6,437	6,437	6,177	6,137	6,137
<i>Softwood Deciduous Species:</i>							
Total		218,298	222,238	221,742	220,771	218,341	217,403
Group I		24,552	26,142	26,128	25,743	24,955	24,857
Group II		55,303	56,591	55,860	55,385	55,093	55,339
Group III		138,443	139,505	139,754	139,643	138,293	137,207

Source: USSR State Committee on Forestry/cab

TABLE C22

	SOVIET UNION: Roundwood Harvest and Wood Deliveries					
	(thousands of cubic meters)					
	Year					
	1980	1985	1986	1987	1988	1989
Wood Harvest:						
Forest Authorities:						
Principle Utilization	327,639	321,948	330,346	339,372	344,860	331,243
Other Utilization	15,449	17,071	20,446	24,463	24,382	22,634
Intermediate Utilization	42,368	45,187	46,311	46,569	45,749	45,356
Harvest under Forest						
Authorities	385,456	384,206	397,103	410,404	414,991	399,233
Estimated Collective Farm						
Harvest	40,000	40,000	40,000	40,000	40,000	40,000
Estimated Harvest From Small						
Harvesting Operations	40,000	40,000	40,000	40,000	40,000	40,000
Estimated Total Harvest	465,456	464,206	477,103	490,404	494,991	479,233
Wood Deliveries:						
Delivered Harvest	356,640	367,961	377,112	389,209	386,406	369,501
Delivered Harvest Conducted	108,816	96,245	99,991	101,195	108,585	109,732
"Outside of Plan" (estimated)						
Estimated Total Wood						
Deliveries	465,456	464,206	477,103	490,404	494,991	479,233
Source: State Committee on Forestry, State Committee on Statistics, C.A. Backman						

TABLE C23

SOVIET UNION: Harvest Under Principal Utilization (from forests managed by the Forest Authorities) - Distributed by Forest Group, by Species Group, and by Year						
			(thousands of cubic meters)			
			Year			
	1980	1985	1986	1987	1988	1989
<i>Forest Groups:</i>						
Total	327,639	321,948	330,346	339,372	344,860	331,243
Group I	22,712	25,290	26,185	27,290	27,446	26,931
Group II	84,764	80,957	83,291	83,588	84,089	81,588
Group III	220,163	215,701	220,870	228,494	233,325	222,726
<i>Species Groups:</i>						
Total	327,639	321,948	330,346	339,372	344,860	331,243
Coniferous	238,761	228,855	233,774	241,256	245,525	235,725
Hardwood Deciduous	7,733	7,707	7,499	7,340	7,773	7,432
Softwood Deciduous	81,145	85,386	89,073	90,776	91,562	88,086
<i>Coniferous Species:</i>						
Total	238,761	228,855	233,774	241,256	245,525	235,725
Group I	9,216	10,841	11,018	11,973	11,955	12,190
Group II	41,484	37,887	38,569	39,417	39,894	38,536
Group III	188,061	180,127	184,187	189,866	193,676	184,999
<i>Hardwood Deciduous Species:</i>						
Total	7,733	7,707	7,499	7,340	7,773	7,432
Group I	2,134	2,226	2,236	2,221	2,239	2,159
Group II	4,529	4,253	4,240	4,109	3,924	3,817
Group III	1,070	1,228	1,023	1,010	1,610	1,456
<i>Softwood Deciduous Species:</i>						
Total	81,145	85,386	89,073	90,776	91,562	88,086
Group I	11,362	12,223	12,931	13,096	13,252	12,582
Group II	38,751	38,817	40,482	40,062	40,271	39,233
Group III	31,032	34,346	35,660	37,618	38,039	36,271

Source: USSR State Committee on Forestry/cab

TABLE C24

SOVIET UNION AND REGIONS: Reserve and Inaccessible Mature and Overmature Growing Stock - Distribution Under Control of the Forest Authorities By Group of Forest and By Species Group						
					Total Species Groups	(millions of cubic meters)
	Total	Group III Forests	Group II Forests	Group I Forests	Coniferous Species Groups	Hardwood Deciduous
SOVIET UNION	22,948	19,513	243	3,192	22,948	21,401
European USSR	1,183	343	119	722	1,183	853
Asian USSR	21,769	19,175	177	2,416	21,769	20,554
Asian USSR:	21,769	19,175	177	2,416	21,769	20,554
Transitional RSFSR	1,547	1,363	13	172	1,547	1,063
Pacific Asian USSR	20,174	17,801	161	2,213	20,174	19,450
Central Asia	47	12	4	31	47	40
<i>Share Within Each Column:</i>						
SOVIET UNION	100%	100%	100%	100%	100%	100%
European USSR	85%	2%	49%	23%	5%	4%
Asian USSR	95%	98%	73%	76%	95%	96%
Asian USSR:	95%	98%	73%	76%	95%	96%
Transitional RSFSR	7%	7%	5%	5%	7%	5%
Pacific Asian USSR	88%	91%	66%	69%	88%	91%
Central Asia	0%	0%	2%	1%	0%	0%
<i>Share Within Each Row:</i>						
SOVIET UNION	100%	85%	1%	14%	100%	93%
European USSR	100%	29%	10%	61%	100%	72%
Asian USSR	100%	88%	1%	11%	100%	94%
Asian USSR:	100%	88%	1%	11%	100%	94%
Transitional RSFSR	100%	88%	1%	11%	100%	69%
Pacific Asian USSR	100%	88%	1%	11%	100%	96%
Central Asia	100%	25%	8%	66%	100%	85%

Source: Economic Geography of the Forest Resources of the USSR/cat

TABLE C25

SOVIET UNION AND REGIONS: Accessible and Potentially Accessible Mature and Overmature Growing Stock - Distribution Under Control of the Forest Authorities By Group of Forest and By Species Group						
					(millions of cubic meters)	
	Total	Group III Forests	Group II Forests	Group I Forests	Total Species Groups	
	Groups					
SOVIET UNION	28,167	24,414	2,080	1,673	28,167	22,589
European USSR	7,761	5,758	1,382	621	7,761	6,022
Asian USSR	20,406	18,656	698	1,052	20,406	16,567
Asian USSR:	20,406	18,656	698	1,052	20,406	16,567
Transitional RSFSR	5,502	5,030	188	284	5,502	3,106
Pacific Asian USSR	14,800	13,565	491	744	14,800	13,387
Central Asia	104	61	19	24	104	74
<i>Share Within Each Column:</i>						
SOVIET UNION	100%	100%	100%	100%	100%	100%
European USSR	28%	24%	66%	37%	28%	27%
Asian USSR	72%	76%	34%	63%	72%	73%
Asian USSR:	72%	76%	34%	63%	72%	73%
Transitional RSFSR	20%	21%	9%	17%	20%	14%
Pacific Asian USSR	53%	56%	2%	44%	53%	59%
Central Asia	0%	0%	1%	1%	0%	0%
<i>Share Within Each Row:</i>						
SOVIET UNION	100%	87%	7%	6%	100%	80%
European USSR	100%	74%	18%	8%	100%	78%
Asian USSR	100%	91%	3%	5%	100%	81%
Asian USSR:	100%	91%	3%	5%	100%	81%
Transitional RSFSR	100%	91%	3%	5%	100%	56%
Pacific Asian USSR	100%	92%	3%	5%	100%	90%
Central Asia	100%	59%	18%	23%	100%	71%

Source: Economic Geography of the Forest Resources of the USSR/cab

TABLE C26

SOVIET UNION AND REGIONS: Distribution of Various Area, forestry, and Forest Industrial Statistics									
Area	Population	Stocked Forest Land	Growing Stock	Allowable Annual Cut	Wood Harvest	Industrial Harvest	Lumber Production	Furniture Plywood Production	Paper Production
1979	1988	1988	c. 1980	c. 1980	1987	1987	1987	1987	1987
			(potentially & currently inaccessible)						
			accessible forest land						
(thousands square kilometers)	(thousands of people)	(thousands hectares)	(millions cubic meters)	(thousands cubic meters)	(thousands cubic meters)	(thousands cubic meters)	(thousands cubic meters)	(thousands cubic meters)	(thousands metric tons)
SOVIET UNION	22,403	262,442	814,252	85,919	636,228	201,200	389,209	302,902	102,455
European Part	5,516	194,341	192,323	24,133	247,097	4,580	238,886	187,932	63,548
Transition RSFSR	2,427	12,959	90,095	10,794	103,473	13,740	36,463	25,010	9,362
Asian Pacific Part	10,339	14,977	515,016	50,572	282,495	182,830	111,414	88,164	25,096
Central Asia	3,994	40,165	16,818	420	3,163	0	2,446	1,796	3,045
<i>Share of each column:</i>									
SOVIET UNION	100%	100%	100%	100%	100%	100%	100%	100%	100%
European Part	25%	74%	24%	28%	39%	2%	61%	62%	84%
Transition RSFSR	11%	5%	11%	13%	16%	7%	9%	9%	94%
Asian Pacific Part	46%	6%	63%	59%	44%	91%	29%	24%	3%
Central Asia	18%	15%	2%	0%	0%	0%	1%	3%	0%

Source: Eastern European Trade in Forest Products, USSR State Committee for Forestry, The Disappearing Russian Forest

TABLE C27

SOVIET UNION AND REGIONS: Stocked Forest Land - Distribution among the Major Regions						
By Species Group and By Age Class			Age Class			
	Species Group		Principle Species Groups	All Age Classes	Mature & Overmature	Less than Mature
Total						
Stocked Forest Land	Coniferous	Hardwood	Softwood	Other	All Age Classes	Mature
		Deciduous	Deciduous	Species		
thousands	thousands	thousands	thousands	thousands	thousands	thousands
hectares	hectares	hectares	hectares	hectares	hectares	hectares
SOVIET UNION:	814,252	567,479	37,035	144,612	65,126	749,126
European Part	192,323	116,317	13,829	61,496	682	191,641
Transition RSFSR	90,095	59,437	4	29,981	674	89,421
Asian Pacific Part	515,016	389,224	13,044	51,609	61,139	453,877
Central Asia	16,818	2,501	10,060	1,526	2,731	14,087
<i>Share of each column:</i>						
SOVIET UNION	100%	100%	100%	100%	100%	100%
European Part	24%	20%	37%	43%	1%	26%
Transition RSFSR	11%	10%	0%	21%	1%	12%
Asian Pacific Part	63%	69%	35%	36%	94%	61%
Central Asia	2%	0%	27%	1%	4%	2%
<i>Share of Each Row:</i>						
SOVIET UNION	100%	70%	5%	18%	8%	100%
European Part	100%	60%	7%	32%	0%	100%
Transition RSFSR	100%	66%	0%	33%	1%	100%
Asian Pacific Part	100%	76%	3%	10%	12%	100%
Central Asia	100%	15%	60%	9%	16%	100%

TABLE C28

SOVIET UNION AND REGIONS: Growing Stock - Distribution among the Major Regions									
By Species Group and By Age Class									
Species Group					Age Class				
					Principle Species Groups				
					All Species	Mature Classes	Overmature	Mature	Less than Mature
Total Growing Stock	Coniferous	Hardwood	Softwood	Other Species	All	Age Classes			
millions	millions	millions	millions	millions	millions				
cubic meters	cubic meters	cubic meters	cubic meters	cubic meters	cubic meters				
SOVIET UNION:	85,919	66,420	3,057	15,022	1,419				
European Part	24,133	15,120	1,880	7,094	39				
Transition RSFSR	10,794	7,221	0	3,567	6				
Asian Pacific Part	50,572	43,828	1,149	4,239	1,356				
Central Asia	420	251	28	124	17				
<i>Share of each column:</i>									
SOVIET UNION	100%	100%	100%	100%	100%				
European Part	28%	23%	62%	47%	3%				
Transition RSFSR	13%	11%	0%	24%	0%				
Asian Pacific Part	59%	66%	38%	28%	96%				
Central Asia	0%	0%	1%	1%	1%				
<i>Share of Each Row:</i>									
SOVIET UNION	100%	77%	4%	17%	2%				
European Part	100%	63%	8%	29%	0%				
Transition RSFSR	100%	67%	0%	33%	0%				
Asian Pacific Part	100%	87%	2%	8%	3%				
Central Asia	100%	60%	7%	29%	4%				
Source: USSR State Committee on Forestry/cab									

TABLE C29

		SOVIET UNION AND REGIONS: Allowable Annual Cut (circa 1980) - Distribution from Forest Resources Managed by the Forest Authorities (excluding forests allocated to long-term uses) by Forest Groups and by Major Species Groups							
		(millions of cubic meters)							
		TOTAL	GROUP III	GROUP II	GROUP I	TOTAL	Coniferous	Hardwood Deciduous	Softwood Deciduous
SOVIET UNION		637	479	106	51	637	403	15	218
European USSR		250	132	87	32	250	137	9	103
Asian USSR		387	348	20	19	387	266	6	115
Asian USSR:		387	348	20	19	387	266	6	115
Transitional RSFSR		103	94	4	5	103	49	0	54
Pacific Asian USSR		280	257	9	14	280	212	6	60
Central Asia		3	2	1	1	3	2	0	1
<i>Share Within Each Column:</i>									
SOVIET UNION		100%	100%	100%	100%	100%	100%	100%	100%
European USSR		39%	27%	82%	62%	39%	34%	61%	47%
Asian USSR		61%	73%	18%	38%	61%	66%	39%	53%
Asian USSR:		61%	73%	18%	38%	61%	66%	39%	53%
Transitional RSFSR		16%	20%	4%	10%	16%	12%	0%	25%
Pacific Asian USSR		44%	54%	8%	28%	44%	53%	37%	28%
Central Asia		1%	0%	1%	2%	1%	0%	2%	1%
<i>Share Within Each Row:</i>									
SOVIET UNION		100%	75%	17%	8%	100%	63%	2%	34%
European USSR		100%	53%	35%	13%	100%	55%	4%	41%
Asian USSR		100%	90%	5%	5%	100%	69%	2%	30%
Asian USSR:		100%	90%	5%	5%	100%	69%	2%	30%
Transitional RSFSR		100%	91%	4%	5%	100%	48%	0%	52%
Pacific Asian USSR		100%	92%	3%	5%	100%	76%	2%	22%
Central Asia		100%	63%	31%	31%	100%	53%	8%	38%

Source: Economic Geography of the Forest Resources of the Soviet Union/cab

TABLE C30

SOVIET UNION AND REGIONS: Allowable Annual Cut - Distribution from Forest Resources Managed by the Forest Authorities (excluding forests allocated to long-term uses) by Year							
		(thousands of cubic meters)					
		1980	1985	1986	1987	1988	1989
SOVIET UNION	638,352	638,270	637,980	636,228	626,753	625,309	
European USSR	250,868	250,236	248,552	247,097	241,901	239,889	
Transition RSFSR	102,861	103,457	103,458	103,473	103,473	103,457	
Asian Pacific USSR	281,428	281,414	282,807	282,495	278,237	278,821	
Central Asia	3,195	3,163	3,163	3,163	3,142	3,142	
<i>Share of each column:</i>							
SOVIET UNION	100%	100%	100%	100%	100%	100%	100%
European USSR	39%	39%	39%	39%	39%	39%	38%
Transition RSFSR	16%	16%	16%	16%	17%	17%	17%
Asian Pacific USSR	44%	44%	44%	44%	44%	44%	45%
Central Asia	1%	0%	0%	0%	1%	1%	1%
Source: USSR State Committee for Forestry/cab							

TABLE C31

SOVIET UNION AND REGIONS: Wood Deliveries - Distribution of Roundwood within the Planned System						
						(thousands of cubic meters)
1940	1960	1970	1980	1985	1986	1987
SOVIET UNION	246,962	369,550	385,019	356,640	367,961	377,112
European USSR	192,306	275,993	260,042	227,137	228,288	229,686
Transition RSFSR	15,988	25,135	30,095	30,534	33,530	34,114
Asian Pacific USSR	35,936	66,056	92,842	96,665	103,759	110,685
Central Asia	2,732	2,366	2,040	2,304	2,385	2,540
<i>Share of each column:</i>						
SOVIET UNION	100%	100%	100%	100%	100%	100%
European USSR	78%	75%	68%	64%	62%	61%
Transition RSFSR	6%	7%	8%	9%	9%	9%
Asian Pacific USSR	15%	18%	24%	27%	28%	29%
Central Asia	1%	1%	1%	1%	1%	1%

Source: USSR State Committee for Statistics/cab

TABLE C32

SOVIET UNION AND REGIONS: Allowable Annual Cut and Harvest (1982) - Distribution from Forests Managed by the Forest Authorities by Major Species Group									
(thousands of cubic meters)									
Allowable Annual Cut (Principle Utilization ^a)									
Harvest under Principal Utilization									
Total	Coniferous Species	Hardwood Species	Softwood Species	Deciduous Species	Total	Coniferous Species	Hardwood Species	Softwood Species	Total Harvest under Principal Utilization
SOVIET UNION	634,266	396,899	15,438	221,929	317,600	225,207	7,711	84,682	376,495
European Part	250,060	134,374	9,496	106,190	192,356	118,925	6,542	66,889	235,490
Transition RSFSR	103,464	49,344	0	54,120	28,630	18,685	0	10,005	34,985
Asian Pacific Part	277,570	211,486	5,684	60,400	94,739	86,663	1,011	7,015	103,392
Central Asia	3,172	1,695	258	1,219	1,815	884	158	773	2,131
<i>Share of each column:</i>									
SOVIET UNION	100%	100%	100%	100%	100%	100%	100%	100%	100%
European Part	39%	34%	62%	48%	61%	55%	85%	79%	63%
Transition RSFSR	16%	12%	0%	24%	9%	8%	0%	12%	9%
Asian Pacific Part	44%	53%	37%	27%	30%	38%	13%	8%	27%
Central Asia	1%	0%	2%	1%	1%	0%	2%	1%	1%
<i>Share of each row:</i>									
SOVIET UNION	100%	63%	2%	35%	100%	71%	2%	27%	100%
European Part	100%	54%	4%	42%	100%	62%	3%	35%	100%
Transition RSFSR	100%	48%	0%	52%	100%	65%	0%	35%	100%
Asian Pacific Part	100%	76%	2%	22%	100%	91%	1%	7%	100%
Central Asia	100%	53%	8%	38%	100%	49%	9%	43%	100%

Source: Soviet Forests at the Crossroads/cab

TABLE C33

		SOVIET UNION AND REGIONS: Stocked Forest Land - Distribution of Land Managed by the Forest Authorities (excluding land covered with species not included in one of the three main species groups) by Species Group and by Species									
		(thousands of hectares)									
		Major Forest Species					Softwood Deciduous				
		Total	Coniferous	Hardwood	Deciduous	Total	Total	Birch	of which:	Black Alder	of which:
		Species	Species	Species	Deciduous	Total	Total	Aspen	Aspen	Alder	Other
SOVIET UNION		685,938	538,715	32,520	114,702	114,702	88,750	18,269	1,801	5,883	
EUROPEAN USSR	155,931	99,938	11,079	44,855	44,855	44,855	32,829	7,351	1,487	3,188	
TRANSITION RSFSR	78,295	56,414	3	21,877	21,877	21,877	17,041	4,719	0	117	
ASIAN PACIFIC USSR	438,141	379,899	11,626	46,617	46,617	46,617	37,985	5,904	312	2,416	
CENTRAL ASIA	13,570	2,404	9,813	1,354	1,354	1,354	895	296	2	161	
		Hardwood Deciduous					of which:				
		Total	of which:	of which:	of which:	of which:	Oak	Beech	Other		
SOVIET UNION		32,520	9,670	2,674	20,177	20,177					
EUROPEAN USSR	11,079	6,603	2,674	1,801	1,801	1,801					
TRANSITION RSFSR	3	0	0	3	3	3					
ASIAN PACIFIC USSR	11,626	3,064	0	8,562	8,562	8,562					
CENTRAL ASIA	9,813	2	0	9,810	9,810	9,810					
		Major Coniferous Forest Species					of which:				
		Total	of which:	of which:	of which:	of which:	Pine	Spruce	True Fir	Larch	Cedar
SOVIET UNION		685,938	538,715	122,194	81,270	81,270	16,362	278,078	40,212	599	
EUROPEAN USSR	155,931	99,938	48,365	49,481	939	49,481	444	695	74		
TRANSITION RSFSR	78,295	56,414	28,744	5,435	3,838	5,435	5,861	12,536	0		
ASIAN PACIFIC USSR	438,141	379,899	44,149	26,046	11,170	26,046	271,599	26,935	0		
CENTRAL ASIA	13,570	2,404	936	257	174	257	416	46	574		

Source: USSR State Committee on Forestry/cab

TABLE C34

SOVIET UNION AND REGIONS: Growing Stock - Distribution of Land Managed by the Forest Authorities (excluding land covered with species not included in one of the three main species groups) by Species Group and by Species											
									(millions of cubic meters)		
Major Forest Species	Coniferous	Hardwood			Softwood			of which: Birch Aspen	of which: Black Alder Other		
		Deciduous	Deciduous	Total	Deciduous	Deciduous	Total				
		Total	Total		Total	Total					
SOVIET UNION	76,788	62,132	2,711	11,945	11,945	8,334	2,669	206	736		
EUROPEAN USSR	19,468	12,601	1,636	5,232	5,232	3,508	1,103	191	430		
TRANSITION RSFSR	9,565	6,793	0	2,772	2,772	1,994	771	0	8		
ASIAN PACIFIC USSR	47,366	42,494	1,050	3,823	3,823	2,753	769	15	286		
CENTRAL ASIA	388	245	26	117	117	79	26	0	13		
Hardwood											
Deciduous											
Major Forest Species	Coniferous	of which:			of which:			of which: Birch Aspen	of which: Black Alder Other		
		Total	of which:	Oak	Beech	Other					
SOVIET UNION	2,711	1,106	594	594	1,012						
EUROPEAN USSR	1,636	845	594	594	197						
TRANSITION RSFSR	0	0	0	0	0						
ASIAN PACIFIC USSR	1,050	260	0	789	26						
CENTRAL ASIA	26	0	0	26							
Coniferous											
Spruce											
Major Forest Species	Coniferous	of which:			of which:			of which: Larch Cedar	of which: Others		
		Total	of which:	Pine	Spruce	True Fir					
SOVIET UNION	76,788	62,132	15,590	11,206	2,722	25,193	7,409	13			
EUROPEAN USSR	19,468	12,601	5,811	6,365	230	56	138	1			
TRANSITION RSFSR	9,565	6,793	2,972	639	507	617	2,057	0			
ASIAN PACIFIC USSR	47,366	42,494	6,713	4,160	1,925	24,491	5,205	0			
CENTRAL ASIA	388	245	93	41	60	29	9	12			

Source: LISSB State Committee on Forestry/cab

TABLE C35

		EUROPEAN USSR: Stocked Forest Land - Distribution			
		Among Agencies With Administrative Responsibilities			
		By Species Group			
		(thousands of hectares)			
Total Stocked Forest Land		Coniferous	Hardwood	Softwood	Other species
Deciduous		Deciduous	Deciduous		
EUROPEAN USSR:					
TOTAL IN THE FOREST FUND	192,323	116,317	13,829	61,496	682
Collective Farms	13,194	5,558	1,539	6,098	0
Government Significant Forests	179,129	110,759	12,390	55,399	581
GOV. SIGNIFICANT FORESTS	179,129	110,759	12,390	55,399	581
Forest Ministry Forests	138,454	86,310	10,469	41,111	565
Forests set aside for other Organizations	40,675	24,449	1,921	14,287	17
FOREST MINISTRY FORESTS	138,454	86,310	10,469	41,111	565
Forests for longterm uses	5,008	3,956	34	998	20
Ministry Forests excluding those for longterm uses	133,447	82,354	10,435	40,113	544
OTHER MINISTRY FORESTS	40,675	24,449	1,921	14,287	17
Government Farm Forests	16,151	6,650	819	8,681	1
Forest Industry Forests	18,046	13,688	610	3,744	4
Other Ministries	6,478	4,111	492	1,862	12
FARM FORESTS	29,345	12,208	2,358	14,779	1
Collective Farm Forests	13,194	5,558	1,539	6,098	0
Government Farm Forests	16,151	6,650	819	8,681	1
FORESTS AVAILABLE FOR USE BY FOREST INDUSTRY	151,493	96,042	11,045	43,857	548
Ministry Forests excluding those for longterm uses	133,447	82,354	10,435	40,113	544
Forest Industry Forests	18,046	13,688	610	3,744	4

Source: USSR State Committee on Forestry/cab

TABLE C36

	EUROPEAN USSR: Growing Stock - Distribution Among Agencies With Administrative Responsibilities				
	By Species Group				
	(millions of cubic meters)				
	Total	Coniferous	Hardwood	Softwood	Other
	Volume in Forest Fund		Deciduous	Deciduous	Species
EUROPEAN USSR:					
TOTAL IN THE FOREST FUND	24,133	15,120	1,880	7,094	39
Collective Farms	1,606	845	118	643	0
Government Significant Forests	22,527	14,275	1,761	6,451	40
GOV. SIGNIFICANT FORESTS	22,527	14,275	1,761	6,451	40
Forest Ministry Forests	17,297	10,949	1,502	4,808	37
Forests set aside for other Organizations	5,230	3,326	258	1,643	3
FOREST MINISTRY FORESTS	17,297	10,949	1,502	4,808	37
Forests for longterm uses	325	277	6	42	0
Ministry Forests excluding those for longterm uses	16,972	10,672	1,497	4,766	37
OTHER MINISTRY FORESTS	5,230	3,326	258	1,643	3
Government Farm Forests	2,125	1,085	54	986	0
Forest Industry Forests	2,209	1,651	133	424	1
Other Ministries	896	590	72	233	2
FARM FORESTS	3,730	1,929	172	1,629	0
Collective Farm Forests	1,606	845	118	643	0
Government Farm Forests	2,125	1,085	54	986	0
FORESTS AVAILABLE FOR USE BY FOREST INDUSTRY	19,180	12,323	1,630	5,190	38
Ministry Forests excluding those for longterm uses	16,972	10,672	1,497	4,766	37
Forest Industry Forests	2,209	1,651	133	424	1

Source: USSR State Committee on Forestry/cab

TABLE C37

EUROPEAN USSR: Forest Land - Distribution Under Control					
	Of Forest Authorities (excluding forests allocated to long-term uses) To Groups I, II, and III Forests				
	(thousands of hectares)				
	Total	Stocked Forest	Unstocked Forest	Plantations Crown not Closed	Plantations Nurseries Other
		Land	Land		
EUROPEAN USSR:					
Group 1 Forests	45,830	44,173	897	702	58
Group 2 Forests	45,616	43,134	1,053	1,409	20
Group 3 Forests	67,556	64,163	2,345	1,047	1
of which:					
Special Zoned Forests	166	162	4	0	0
Reserve Forests	385	369	16	0	0
Operational Forests	67,005	63,632	2,325	1,047	1
Total Area of Group 1, 2, and 3					
Forests	159,001	151,470	4,294	3,157	79
<i>Percent of column:</i>					
Group 1 Forests	29%	29%	21%	22%	73%
Group 2 Forests	29%	28%	25%	45%	26%
Group 3 Forests	42%	42%	55%	33%	2%
of which:					
Special Zoned Forests	0%	0%	0%	0%	0%
Reserve Forests	0%	0%	0%	0%	0%
Operational Forests	42%	42%	54%	33%	2%
Total Area of Group 1, 2, and 3					
Forests	100%	100%	100%	100%	100%
<i>Percent of row:</i>					
Group 1 Forests	100%	96%	2%	2%	0%
Group 2 Forests	100%	95%	2%	3%	0%
Group 3 Forests	100%	95%	3%	2%	0%
of which:					
Special Zoned Forests	100%	97%	2%	0%	0%
Reserve Forests	100%	96%	4%	0%	0%
Operational Forests	100%	95%	3%	2%	0%
Total Area of Group 1, 2, and 3					
Forests	100%	95%	3%	2%	0%

Source: USSR State Committee on Forestry/cab

TABLE C38

EUROPEAN USSR: Unstocked Forest Land - Distribution					
Under Control Of Forest Authorities (excluding forests allocated to long-term uses) To Groups I, II, and III Forests					
(thousands of hectares)					
	Total	Unstocked	Glades	Burned/killed	Cutover
					Open or Wasteland
EUROPEAN USSR:					
Group 1 Forests	897	149	72	312	364
Group 2 Forests	1,053	26	63	866	98
Group 3 Forests	2,345	33	72	2,181	58
of which:					
Special Zoned Forests	4	0	0	4	0
Reserve Forests	16	4	0	0	12
Operational Forests	2,325	28	72	2,178	47
Total Area of Group 1, 2, and 3					
Forests	4,294	208	207	3,360	520
<i>Percent of column:</i>					
Group 1 Forests	21%	72%	35%	9%	70%
Group 2 Forests	25%	13%	30%	26%	19%
Group 3 Forests	55%	16%	35%	65%	11%
of which:					
Special Zoned Forests	0%	0%	0%	0%	0%
Reserve Forests	0%	2%	0%	0%	2%
Operational Forests	54%	14%	35%	65%	9%
Total Area of Group 1, 2, and 3					
Forests	100%	100%	100%	100%	100%
<i>Percent of row:</i>					
Group 1 Forests	100%	17%	8%	35%	41%
Group 2 Forests	100%	2%	6%	82%	9%
Group 3 Forests	100%	1%	3%	93%	2%
of which:					
Special Zoned Forests	100%	10%	3%	88%	0%
Reserve Forests	100%	26%	0%	0%	74%
Operational Forests	100%	1%	3%	94%	2%
Total Area of Group 1, 2, and 3					
Forests	100%	5%	5%	78%	12%

Source: USSR State Committee on Forestry/cab

TABLE C39

EUROPEAN USSR: Groups I, II, and III Forests Combined - Distribution Of Stocked Forest Land Under Control Of Forest Authorities (excluding forests allocated to long-term uses) by Major Species Group, Specie, and Age Class						
			(thousands of hectares)			
				Age Class		
Stocked						
Forest	Young class I	Young class II		Middle Aged	Approaching	Mature &
Land					Mature	Overmature
Principle Forest Species						
Coniferous Species						
Pine	47,646	9,532	10,217	12,278	4,119	11,500
Spruce	46,389	6,788	3,679	4,769	2,978	28,176
True Firs	938	65	58	180	121	513
Larch	338	41	26	31	17	223
Korean Pine	695	27	6	224	165	273
Juniper	24	1	1	11	3	8
Total Coniferous Species	96,030	16,455	13,987	17,493	7,403	40,693
Hardwood Deciduous Species						
High stump Oak	3,388	551	826	1,491	254	267
Low stump Oak	3,193	83	176	1,710	542	683
Beech	2,666	59	184	1,278	394	752
Hornbeam	729	4	22	396	113	194
Ash	341	60	74	140	43	24
Maple	302	19	17	46	13	206
Elm	196	31	42	86	15	23
Stone Birch						
Saksaul	1		0	0	0	0
White Acasia	228	23	34	112	31	28
Total Hardwood Deciduous	11,044	829	1,375	5,259	1,404	2,177
Softwood Deciduous Species						
Birch	31,872	3,977	3,860	14,415	3,341	6,279
Aspen	7,338	1,212	986	1,351	967	2,822
Gray Alder	629	18	54	219	200	137
Black Alder	1,479	155	180	736	215	193
Lime Tree	2,127	200	237	1,094	197	399
Popular	253	18	24	79	35	97
Ivy	150	11	14	42	20	63
Total Softwood Deciduous	43,848	5,591	5,356	17,937	4,974	9,990
Total Main Forest Species	150,922	22,874	20,718	40,688	13,782	52,860
Other Tree Species	308	36	37	123	36	76
Brush	240	7	32	48	21	132
Total Species	151,470	22,917	20,788	40,859	13,839	53,068

Source: USSR State Committee on Forestry/cab

TABLE C40

EUROPEAN USSR: Groups I, II, and III Forests Combined - Distribution Of Volume Under Control Of Forest Authorities (excluding forests allocated to long-term uses) by Major Species Group, Specie, and Age Class						
			(millions of cubic meters)			
				Age Class		
Standing	Volume	Young class I	Young class II	Middle Aged	Approaching	Mature &
					Mature	Overmature
Principle Forest Species						
Coniferous Species						
Pine	5,756	202	939	2,170	856	1,589
Spruce	6,152	117	215	811	652	4,357
True Firs	230	2	5	44	36	143
Larch	45	2	3	5	3	32
Korean Pine	138	0	0	48	35	55
Juniper	1		0	0	0	0
Total Coniferous Species	12,322	323	1,163	3,077	1,582	6,176
Hardwood Deciduous Species						
High stump Oak	469	17	73	263	56	60
Low stump Oak	372	1	7	188	76	100
Beech	592	3	24	259	97	209
Hornbeam	101	0	1	48	18	34
Ash	38	2	7	17	8	4
Maple	34	0	1	4	2	26
Elm	12	0	2	6	1	3
Stone Birch						
Saksaul						
White Acasia	12	0	1	6	2	3
Total Hardwood Deciduous	1,630	24	116	791	260	439
Softwood Deciduous Species						
Birch	3,469	35	138	1,728	586	981
Aspen	1,101	16	65	181	175	665
Gray Alder	66	0	3	21	23	19
Black Alder	190	2	9	103	39	35
Lime Tree	317	3	13	182	40	78
Popular	33	0	1	9	5	18
Ivy	13	0	0	3	2	8
Total Softwood Deciduous	5,188	57	231	2,227	870	1,804
Total Main Forest Species	19,139	404	1,510	6,095	2,712	8,419
Other Tree Species	33	1	2	9	5	17
Brush	4	0	0	1	0	2
Total Species	19,177	405	1,512	6,105	2,717	8,438

Source: USSR State Committee on Forestry/cab

TABLE C41

EUROPEAN USSR: Site Class - Distribution of Stocked Forest Land						
Administered By Forest Authorities (including that allocated to long-term uses) By Major Species Group (excluding species not included in one of the three species groups)						
(thousands of hectares)						
Site Class						
Site Class	Site Class	Site Class	Site Class	Site Class	Site Class	Total
2 and higher	3	4	5	Below 5	Stocked	
All	All	All	All	All	Forest	
Stocking	Stocking	Stocking	Stocking	Stocking	Land	
EUROPEAN USSR:						
Coniferous Species	23,642	15,393	19,570	27,008	14,385	99,998
Hardwood Deciduous Species	4,458	3,663	2,008	704	245	11,079
Softwood Deciduous Species	22,289	11,101	6,315	3,201	1,948	44,855
Total Area of Coniferous and Deciduous Species	50,389	30,158	27,893	30,913	16,578	155,932
<i>Percent of column:</i>						
Coniferous Species	47%	51%	70%	87%	87%	64%
Hardwood Deciduous Species	9%	12%	7%	2%	1%	7%
Softwood Deciduous Species	44%	37%	23%	10%	12%	29%
Total Area of Coniferous and Deciduous Species	100%	100%	100%	100%	100%	100%
<i>Percent of row:</i>						
Coniferous Species	24%	15%	20%	27%	14%	100%
Hardwood Deciduous Species	40%	33%	18%	6%	2%	100%
Softwood Deciduous Species	50%	25%	14%	7%	4%	100%
Total Area of Coniferous and Deciduous Species	32%	19%	18%	20%	11%	100%
Source: USSR State Committee on Forestry/cab						

TABLE C42

EUROPEAN USSR: Stocking Class - Distribution of Stocked Forest Land Administered By Forest Authorities (including that allocated to long-term uses) By Major Species Group (excluding species not included in one of the three species groups)				
(thousands of hectares)				
	Stocking Class good	Stocking Class medium	Stocking Class poor	Total Stocked Forest Land
EUROPEAN USSR:				
Coniferous Species	19,040	69,922	11,036	99,998
Hardwood Deciduous Species	2,727	7,502	850	11,079
Softwood Deciduous Species	18,029	24,295	2,529	44,855
Total Area of Coniferous and Deciduous Species	39,796	101,720	14,415	155,932
<i>Percent of column:</i>				
Coniferous Species	48%	69%	77%	64%
Hardwood Deciduous Species	7%	7%	6%	7%
Softwood Deciduous Species	45%	24%	18%	29%
Total Area of Coniferous and Deciduous Species	100%	100%	100%	100%
<i>Percent of row:</i>				
Coniferous Species	19%	70%	11%	100%
Hardwood Deciduous Species	25%	68%	8%	100%
Softwood Deciduous Species	40%	54%	6%	100%
Total Area of Coniferous and Deciduous Species	26%	65%	9%	100%
Source: USSR State Committee on Forestry/cab				

TABLE C43

TABLE C43

EUROPEAN USSR: Mountain Forests (excluding forests allocated for long term uses) - Distribution of Stocked Forest Land By Group of Forest and By Principal Species Group						
						(thousands of hectares)
	Total					
	Stocked Forest					
	Coniferous Land	Hardwood Species	Softwood	Other	Brush	
		Deciduous		Species	Species	
EUROPEAN USSR:						
Group 1	9,151	2,868	4,020	1,975	101	188
Group 2	5,371	2,456	932	1,958	26	0
Group 3	5,999	3,410	344	2,244	0	1
Total Mountain Forests in Groups 1, 2, and 3 Forests	20,522	8,733	5,297	6,177	126	189
<i>Percent of column:</i>						
Group 1	45%	33%	76%	32%	80%	99%
Group 2	26%	28%	18%	32%	20%	0%
Group 3	29%	39%	7%	36%	0%	0%
Total Mountain Forests in Groups 1, 2, and 3 Forests	100%	100%	100%	100%	100%	100%
<i>Percent of row:</i>						
Group 1	100%	31%	44%	22%	1%	2%
Group 2	100%	46%	17%	36%	0%	0%
Group 3	100%	57%	6%	37%	0%	0%
Total Mountain Forests in Groups 1, 2, and 3 Forests	100%	43%	26%	30%	1%	1%
Source: USSR State Committee on Forestry/cab						

TABLE C44

EUROPEAN USSR: Mountain Forests (excluding forests allocated to long-term uses) - Distribution of Growing Stock By Group of Forest and By Principal Species Group				
	(millions of cubic meters)			
	Total Growing Stock	Coniferous Species	Hardwood Deciduous	Softwood Deciduous
EUROPEAN USSR:				
Group 1	1,625	653	699	273
Group 2	768	379	179	210
Group 3	777	469	40	269
Total Mountain Forests				
in Groups 1, 2, and 3 Forests	3,170	1,500	917	753
<i>Percent of column:</i>				
Group 1	51%	44%	76%	36%
Group 2	24%	25%	20%	28%
Group 3	25%	31%	4%	36%
Total Mountain Forests				
In Groups 1, 2, and 3 Forests	100%	100%	100%	100%
<i>Percent of row:</i>				
Group 1	100%	40%	43%	17%
Group 2	100%	49%	23%	27%
Group 3	100%	60%	5%	35%
Total Mountain Forests				
In Groups 1, 2, and 3 Forests	100%	47%	29%	24%
Source: USSR State Committee on Forestry/cab				

TABLE C45

EUROPEAN USSR: Stocked Forest Land (excluding that allocated to long-term uses) - Distribution Under Control of Forest Authorities by Mountain and Non-mountain Category and by Species Group and by Age Class						
(thousands of hectares)						
Total Stocked Forest Land	Coniferous Species	Hardwood Species	Softwood Species	Other Species	Principle Three Species Groups	
EUROPEAN USSR:					All Ages	Mature & Less than mature
Mountain Forests	20,522	8,733	5,297	6,177	315	20,207
Non-Mountain Forests	130,970	87,309	5,749	37,680	233	130,738
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	151,492	96,042	11,045	43,857	548	150,944
<i>Percent of column:</i>						
Mountain Forests	14%	9%	48%	14%	58%	13%
Non-Mountain Forests	86%	91%	52%	86%	42%	87%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	100%	100%	100%	100%	100%
<i>Percent of row:</i>						
Mountain Forests	100%	43%	26%	30%	2%	100%
Non-Mountain Forests	100%	67%	4%	29%	0%	100%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	63%	7%	29%	0%	100%

Source: USSR State Committee on Forestry/Gorniye Lesa/cab

TABLE C46

EUROPEAN USSR: Growing Stock (excluding that allocated to long-term uses) - Distribution Under Control of Forest Authorities by Mountain and Non-mountain Category						
					All Ages	Mature & Less than mature
					(millions of cubic meters)	
Total						Principle Three Species Groups
Growing Stock	Coniferous Species	Hardwood Species	Softwood Species	Deciduous Species		
EUROPEAN USSR:					All Ages	Overmature
Mountain Forests	3,170	1,500	917	753	0	3,170
Non-Mountain Forests	16,010	10,823	713	4,437	37	15,973
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	19,180	12,323	1,630	5,190	37	19,143
Percent of column:						
Mountain Forests	17%	12%	56%	15%	0%	17%
Non-Mountain Forests	83%	88%	44%	85%	100%	83%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	100%	100%	100%	100%	100%
Percent of row:						
Mountain Forests	100%	47%	29%	24%	0%	100%
Non-Mountain Forests	100%	68%	4%	28%	0%	100%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	64%	8%	27%	0%	100%

Source: USSR State Committee on Forestry/Gorniye Lesa/cab

TABLE C47

TRANSITION RSFSR: Stocked Forest Land - Distribution					
Among Agencies With Administrative Responsibilities					
By Species Group					
(thousands of hectares)					
Total					
Stocked					
Forest	Coniferous	Hardwood	Softwood	Other species	
Land		Deciduous	Deciduous		
TRANSITION RSFSR:					
TOTAL IN THE FOREST FUND	90,095	59,437	4	29,981	674
Collective Farms	2,748	447	0	2,301	0
Government Significant Forests	87,347	58,990	4	27,680	674
GOV. SIGNIFICANT FORESTS	87,347	58,990	4	27,680	674
Forest Ministry Forests	78,734	56,347	3	21,862	522
Forests set aside for other Organizations	8,613	2,643	0	5,818	152
FOREST MINISTRY FORESTS	78,734	56,347	3	21,862	522
Forests for longterm uses	5,099	4,567	0	510	23
Ministry Forests excluding those for longterm uses	73,635	51,781	3	21,352	499
OTHER MINISTRY FORESTS	8,613	2,643	0	5,818	152
Government Farm Forests	6,446	1,156	0	5,290	0
Forest Industry Forests	83	67	0	16	0
Other Ministries	2,084	1,420	0	512	151
FARM FORESTS	9,194	1,602	0	7,591	0
Collective Farm Forests	2,748	447	0	2,301	0
Government Farm Forests	6,446	1,156	0	5,290	0
FORESTS AVAILABLE FOR USE BY FOREST INDUSTRY	73,718	51,847	3	21,368	499
Ministry Forests excluding those for longterm uses	73,635	51,781	3	21,352	499
Forest Industry Forests	83	67	0	16	0

Source: USSR State Committee for Forestry/cab

TABLE C48

TRANSITION RSFSR: Growing Stock - Distribution Among Agencies With Administrative Responsibilities					
By Species Group					
(millions of cubic meters)					
Total	Coniferous	Hardwood	Softwood	Other	
Volume in Forest Fund		Deciduous	Deciduous	Species	
TRANSITION RSFSR:					
TOTAL IN THE FOREST FUND	10,794	7,221	0	3,567	6
Collective Farms	278	60	0	217	0
Government Significant Forests	10,516	7,161	0	3,349	6
GOV. SIGNIFICANT FORESTS	10,516	7,161	0	3,349	6
Forest Ministry Forests	9,557	6,782	0	2,770	5
Forests set aside for other Organizations	959	379	0	579	1
FOREST MINISTRY FORESTS	9,557	6,782	0	2,770	5
Forests for longterm uses	384	344	0	40	0
Ministry Forests excluding those for longterm uses	9,173	6,438	0	2,730	5
OTHER MINISTRY FORESTS	959	379	0	579	1
Government Farm Forests	680	168	0	512	0
Forest Industry Forests	13	11	0	2	0
Other Ministries	266	200	0	65	1
FARM FORESTS	958	228	0	729	0
Collective Farm Forests	278	60	0	217	0
Government Farm Forests	680	168	0	512	0
FORESTS AVAILABLE FOR USE BY FOREST INDUSTRY	9,186	6,448	0	2,733	5
Ministry Forests excluding those for longterm uses	9,173	6,438	0	2,730	5
Forest Industry Forests	13	11	0	2	0

Source: USSR State Committee for Forestry/cab

TABLE C49

TRANSITION RSFSR: Forest Land - Distribution Under Control Of Forest Authorities (excluding forests allocated to long-term uses) To Groups I, II, and III Forests					
	(thousands of hectares)				
	Total	Stocked Forest Land	Unstocked Forest Land	Plantations Crown not Closed	Plantations Nurseries Other
TRANSITION RSFSR:					
Group 1 Forests	12,825	11,770	983	68	3
Group 2 Forests	3,067	2,857	139	70	1
Group 3 Forests	62,721	59,091	3,365	266	0
of which:					
Special Zoned Forests	0	0	0	0	0
Reserve Forests	10,190	9,714	474	1	0
Operational Forests	52,532	49,377	2,890	265	0
Total Area of Group 1, 2, and 3					
Forests	78,613	73,718	4,487	404	4
<i>Share of each column:</i>					
Group 1 Forests	16%	16%	22%	17%	81%
Group 2 Forests	4%	4%	3%	17%	12%
Group 3 Forests	80%	80%	75%	66%	7%
of which:					
Special Zoned Forests	0%	0%	0%	0%	0%
Reserve Forests	13%	13%	11%	0%	0%
Operational Forests	67%	67%	64%	66%	7%
Total Area of Group 1, 2, and 3					
Forests	100%	100%	100%	100%	100%
<i>Share of each row:</i>					
Group 1 Forests	100%	92%	8%	1%	0%
Group 2 Forests	100%	93%	5%	2%	0%
Group 3 Forests	100%	94%	5%	0%	0%
of which:					
Special Zoned Forests					
Reserve Forests	100%	95%	5%	0%	0%
Operational Forests	100%	94%	6%	1%	0%
Total Area of Group 1, 2, and 3					
Forests	100%	94%	6%	1%	0%

Source: USSR State Committee on Forestry/cab

TABLE C50

TRANSITION RSFSR: Unstocked Forest Land - Distribution Under Control Of Forest Authorities (excluding forests allocated to long-term uses) To Groups I, II, and III Forests					
(thousands of hectares)					
	Total Unstocked	Glades	Burned/killed	Cutover	Open or Wasteland
TRANSITION RSFSR:					
Group 1 Forests	983	718	150	56	60
Group 2 Forests	139	42	10	66	21
Group 3 Forests	3,365	1,528	859	769	209
of which:					
Special Zoned Forests	0	0	0	0	0
Reserve Forests	474	262	168	27	17
Operational Forests	2,890	1,266	691	742	192
Total Area of Group 1, 2, and 3					
Forests	4,487	2,288	1,019	891	289
<i>Share of each column:</i>					
Group 1 Forests	22%	31%	15%	6%	21%
Group 2 Forests	3%	2%	1%	7%	7%
Group 3 Forests	75%	67%	84%	86%	72%
of which:					
Special Zoned Forests	0%	0%	0%	0%	0%
Reserve Forests	11%	11%	17%	3%	6%
Operational Forests	64%	55%	68%	83%	66%
Total Area of Group 1, 2, and 3					
Forests	100%	100%	100%	100%	100%
<i>Share of each row:</i>					
Group 1 Forests	100%	73%	15%	6%	6%
Group 2 Forests	100%	30%	7%	47%	15%
Group 3 Forests	100%	45%	26%	23%	6%
of which:					
Special Zoned Forests					
Reserve Forests	100%	55%	35%	6%	4%
Operational Forests	100%	44%	24%	26%	7%
Total Area of Group 1, 2, and 3					
Forests	100%	51%	23%	20%	6%

Source: USSR State Committee on Forestry/cab

TABLE C51

TRANSITION RSFSR: Site Class - Distribution of Stocked Forest Land Administered By Forest Authorities (including that allocated to long-term uses) By Major Species Group (excluding species not included in one of the three species groups)						
						(thousands of hectares)
				Site Class		
	2 and higher	3	4	5	Below 5	Total Stocked Forest Land
	All	All	All	All	All	
	Stocking	Stocking	Stocking	Stocking	Stocking	
Transition RSFSR:						
Coniferous Species	2,863	7,083	12,466	17,737	16,264	56,414
Hardwood Deciduous Species	1	2	1	0	0	3
Softwood Deciduous Species	6,494	7,036	4,364	2,663	1,320	21,877
Total Area of Coniferous and Deciduous Species	9,358	14,121	16,831	20,400	17,585	78,295
<i>Share of each column:</i>						
Coniferous Species	31%	50%	74%	87%	92%	72%
Hardwood Deciduous Species	0%	0%	0%	0%	0%	0%
Softwood Deciduous Species	69%	50%	26%	13%	8%	28%
Total Area of Coniferous and Deciduous Species	100%	100%	100%	100%	100%	100%
<i>Share of each row:</i>						
Coniferous Species	5%	13%	22%	31%	29%	100%
Hardwood Deciduous Species	24%	48%	27%			100%
Softwood Deciduous Species	30%	32%	20%	12%	6%	100%
Total Area of Coniferous and Deciduous Species	12%	18%	21%	26%	22%	100%

Source: USSR State Committee on Forestry/cab

TABLE C52

TRANSITION RSFSR: Stocking Class - Distribution of Stocked Forest Land Administered By Forest Authorities (including that allocated to long-term uses) By Major Species Group (excluding species not included in one of the three species groups)				
(thousands of hectares)				
	Stocking Class good	Stocking Class medium	Stocking Class poor	Total Stocked Forest Land
Transition RSFSR:				
Coniferous Species	4,156	33,967	18,291	56,414
Hardwood Deciduous Species	0	2	1	3
Softwood Deciduous Species	4,066	13,870	3,942	21,877
Total Area of Coniferous and Deciduous Species	8,222	47,839	22,234	78,295
<i>Share of each column:</i>				
Coniferous Species	51%	71%	82%	72%
Hardwood Deciduous Species	0%	0%	0%	0%
Softwood Deciduous Species	49%	29%	18%	28%
Total Area of Coniferous and Deciduous Species	100%	100%	100%	100%
<i>Share of each row:</i>				
Coniferous Species	7%	60%	32%	100%
Hardwood Deciduous Species	12%	61%	27%	100%
Softwood Deciduous Species	19%	63%	18%	100%
Total Area of Coniferous and Deciduous Species	11%	61%	28%	100%
Source: USSR State Committee for Forestry/cab				

TABLE C53

TRANSITION RSFSR: Mountain Forests (excluding forests allocated for long term uses) - Distribution of Stocked Forest Land By Group of Forest and By Principal Species Group						
Transition RSFSR:						(thousands of hectares)
Total Stocked Forest Land						
Coniferous Land						
Deciduous Land						
Species						
Group 1	1,129	761	0	352	0	15
Group 2	498	180	0	305	0	14
Group 3	6,042	4,249	0	1,706	0	87
Total Mountain Forests in Groups 1, 2, and 3 Forests	7,669	5,190	0	2,363	0	115
<i>Share of each column:</i>						
Group 1	15%	15%		15%	100%	13%
Group 2	8%	3%		13%	0%	12%
Group 3	79%	82%		72%	0%	75%
Total Mountain Forests in Groups 1, 2, and 3 Forests	100%	100%		100%	100%	100%
<i>Share of each row:</i>						
Group 1	100%	67%	0%	31%	0%	1%
Group 2	100%	36%	0%	61%	0%	3%
Group 3	100%	70%	0%	28%	0%	1%
Total Mountain Forests in Groups 1, 2, and 3 Forests	100%	68%	0%	31%	0%	2%
Source: USSR State Committee for Forestry/cab						

TABLE C54

TRANSITION RSFSR: Mountain Forests (excluding forests allocated to long-term uses) - Distribution of Growing Stock By Group of Forest and By Principal Species Group				
(millions of cubic meters)				
	Total Growing Stock	Coniferous Species	Hardwood Deciduous	Softwood Deciduous
Transition RSFSR:				
Group 1	177	138	0	39
Group 2	62	25	0	37
Group 3	767	600	0	167
Total Mountain Forests				
In Groups 1, 2, and 3 Forests	1,006	763	0	243
<i>Share of each column:</i>				
Group 1	18%	18%		16%
Group 2	6%	3%		15%
Group 3	76%	79%		69%
Total Mountain Forests				
In Groups 1, 2, and 3 Forests	100%	100%		100%
<i>Share of each row:</i>				
Group 1	100%	78%	0%	22%
Group 2	100%	40%	0%	60%
Group 3	100%	78%	0%	22%
Total Mountain Forests				
In Groups 1, 2, and 3 Forests	100%	76%	0%	24%
Source: USSR State Committee for Forestry/cab				

TABLE C55

TRANSITION RSFSR: Stocked Forest Land (excluding that allocated to long-term uses) - Distribution Under Control of Forest Authorities by Mountain and Non-mountain Category and by Species Group and by Age Class						
(thousands of hectares)						
Total	Stocked Forest	Coniferous	Hardwood	Softwood	Other	Species Groups
Land	Species	Deciduous	Deciduous	Species		
TRANSITION RSFSR:						
						All Ages Overmature
Mountain Forests	7,669	5,190	0	2,363	115	7,553
Non-Mountain Forests	66,049	46,657	3	19,005	384	65,665
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	73,718	51,847	3	21,368	499	73,219
						41,251
						31,968
<i>Share of each column:</i>						
Mountain Forests	10%	10%	0%	11%	23%	10%
Non-Mountain Forests	90%	90%	100%	89%	77%	90%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	100%	100%	100%	100%	100%
						100%
<i>Share or each row:</i>						
Mountain Forests	100%	68%	0%	31%	2%	100%
Non-Mountain Forests	100%	71%	0%	29%	1%	100%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	70%	0%	29%	1%	100%
						56%
Source: USSR State Committee for Forestry/cab						44%

TABLE C56

TRANSITION RSFSR: Growing Stock (excluding that allocated to long-term uses) - Distribution Under Control of Forest Authorities by Mountain and Non-Mountain Category						
and by Species Group and by Age Class						
(millions of cubic meters)						
Total Growing Stock	Coniferous Species	Hardwood Species	Deciduous Species	Other Species	Groups	Principle Three Species
TRANSITION RSFSR:					All Ages	Mature & Less than mature
Mountain Forests	1,006	763	0	243	0	1,006
Non-Mountain Forests	8,180	5,685	0	2,490	5	8,175
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	9,186	6,448	0	2,733	5	9,181
<i>Share of each column:</i>						
Mountain Forests	11%	12%	0%	9%	0%	11%
Non-Mountain Forests	89%	88%	100%	91%	100%	89%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	100%	100%	100%	100%	100%
<i>Share of each row:</i>						
Mountain Forests	100%	76%	0%	24%	0%	100%
Non-Mountain Forests	100%	70%	0%	30%	0%	100%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	70%	0%	30%	0%	100%

Source: USSR State Committee for Forestry/cab

TABLE C57

	CENTRAL ASIA: Stocked Forest Land - Distribution Among Agencies With Administrative Responsibilities				
	By Species Group				
	(thousands of hectares)				
	Total				
	Stocked				
	Forest	Coniferous	Hardwood	Softwood	Other species
	Land		Deciduous	Deciduous	
CENTRAL ASIA:					
TOTAL IN THE FOREST FUND	16,818	2,501	10,060	1,526	2,731
Collective Farms	60	11	13	36	0
Government Significant	16,758	2,490	10,047	1,490	2,731
Forests					
GOV. SIGNIFICANT FORESTS	16,758	2,490	10,047	1,490	2,731
Forest Ministry Forests	16,301	2,404	9,813	1,354	2,731
Forests set aside for other	457	86	234	136	0
Organizations					
FOREST MINISTRY FORESTS	16,301	2,404	9,813	1,354	2,731
Forests for longterm uses	8,522	281	7,198	9	1,034
Ministry Forests excluding	7,779	2,122	2,615	1,345	1,697
those for longterm uses					
OTHER MINISTRY FORESTS	457	86	234	136	0
Government Farm Forests	365	57	211	98	0
Forest Industry Forests	0	0	0	0	0
Other Ministries	92	30	24	39	0
FARM FORESTS	425	68	223	134	0
Collective Farm Forests	60	11	13	36	0
Government Farm Forests	365	57	211	98	0
FORESTS AVAILABLE FOR					
USE BY FOREST INDUSTRY	7,779	2,122	2,615	1,345	1,697
Ministry Forests excluding	7,779	2,122	2,615	1,345	1,697
those for longterm uses					
Forest Industry Forests	0	0	0	0	0

Source: USSR State Committee for Forestry/cab

TABLE C58

	CENTRAL ASIA: Growing Stock - Distribution Among Agencies With Administrative Responsibilities					
	By Species Group					
	(millions of cubic meters)					
	Total	Coniferous	Hardwood	Softwood	Other	
	Volume in Forest Fund		Deciduous	Deciduous	Species	
CENTRAL ASIA:						
TOTAL IN THE FOREST FUND	420	251	28	124	17	
Collective Farms	2	1	0	1	0	
Government Significant Forests	418	251	28	123	17	
GOV. SIGNIFICANT FORESTS	418	251	28	123	17	
Forest Ministry Forests	405	245	26	117	17	
Forests set aside for other Organizations	13	6	2	5	0	
FOREST MINISTRY FORESTS	405	245	26	117	17	
Forests for longterm uses	29	7	17	0	4	
Ministry Forests excluding those for longterm uses	376	237	9	117	13	
OTHER MINISTRY FORESTS	13	6	2	5	0	
Government Farm Forests	4	1	1	1	0	
Forest Industry Forests	0	0	0	0	0	
Other Ministries	9	4	1	4	0	
FARM FORESTS	6	2	2	2	0	
Collective Farm Forests	2	1	0	1	0	
Government Farm Forests	4	1	1	1	0	
FORESTS AVAILABLE FOR USE BY FOREST INDUSTRY	376	237	9	117	13	
Ministry Forests excluding those for longterm uses	376	237	9	117	13	
Forest Industry Forests	0	0	0	0	0	

Source: USSR State Committee for Forestry/cab

TABLE C59

CENTRAL ASIA: Forest Land - Distribution Under Control					
Of Forest Authorities (excluding forests allocated to long-term uses) To Groups I, II, and III Forests					
(thousands of hectares)					
	Total	Stocked Forest	Unstocked Forest	Plantations Crown not Closed	Plantations Nurseries Other
		Land	Land		
CENTRAL ASIA:					
Group 1 Forests	11,146	6,801	4,000	338	6
Group 2 Forests	352	292	55	6	0
Group 3 Forests	912	686	211	15	0
of which:					
Special Zoned Forests	0	0	0	0	0
Reserve Forests	75	61	13	1	0
Operational Forests	837	625	198	14	0
Total Area of Group 1, 2, and 3					
Forests	12,410	7,779	4,266	358	6
<i>Share of each column:</i>					
Group 1 Forests	90%	87%	94%	94%	100%
Group 2 Forests	3%	4%	1%	2%	0%
Group 3 Forests	7%	9%	5%	4%	0%
of which:					
Special Zoned Forests					
Reserve Forests					
Operational Forests					
Total Area of Group 1, 2, and 3					
Forests	100%	100%	100%	100%	100%
<i>Share of each row:</i>					
Group 1 Forests	100%	61%	36%	3%	0%
Group 2 Forests	100%	83%	15%	2%	0%
Group 3 Forests	100%	75%	23%	2%	0%
of which:					
Special Zoned Forests					
Reserve Forests	100%	82%	17%	1%	0%
Operational Forests	100%	75%	24%	2%	0%
Total Area of Group 1, 2, and 3					
Forests	100%	63%	34%	3%	0%

Source: USSR State Committee on Forestry/cab

TABLE C60

CENTRAL ASIA: Unstocked Forest Land - Distribution Under Control Of Forest Authorities (excluding forests allocated to long-term uses) To Groups I, II, and III Forests						
(thousands of hectares)						
	Total	Unstocked	Glades	Burned/killed	Cutover	Open or Wasteland
CENTRAL ASIA:						
Group 1 Forests	4,000	2,230		43	133	1,595
Group 2 Forests	55	32		1	6	16
Group 3 Forests	211	97		11	19	84
of which:						
Special Zoned Forests	0	0		0	0	0
Reserve Forests	13	6		5	0	2
Operational Forests	198	91		6	19	82
Total Area of Group 1, 2, and 3						
Forests	4,266	2,359		55	158	1,695
<i>Share of each column:</i>						
Group 1 Forests	94%	95%		78%	84%	94%
Group 2 Forests	1%	1%		1%	3%	1%
Group 3 Forests	5%	4%		21%	12%	5%
of which:						
Special Zoned Forests						
Reserve Forests						
Operational Forests						
Total Area of Group 1, 2, and 3						
Forests	100%	100%		100%	100%	100%
<i>Share of each row:</i>						
Group 1 Forests	100%	56%		1%	3%	40%
Group 2 Forests	100%	59%		1%	10%	29%
Group 3 Forests	100%	46%		5%	9%	40%
of which:						
Special Zoned Forests						
Reserve Forests	100%	45%		39%	0%	16%
Operational Forests	100%	46%		3%	10%	41%
Total Area of Group 1, 2, and 3						
Forests	100%	55%		1%	4%	40%

Source: USSR State Committee on Forestry/cab

TABLE C61

CENTRAL ASIA: Site Class - Distribution of Stocked Forest Land						
Administered By Forest Authorities (Including that allocated to long-term uses) By Major Species Group (excluding species not included in one of the three species groups)						
(thousands of hectares)						
Site Class						
	2 and higher	3	4	5	Below 5	Total
	All	All	All	All	All	Stocked Forest Land
	Stocking	Stocking	Stocking	Stocking	Stocking	
CENTRAL ASIA:						
Coniferous Species	254	762	1,072	257	60	2,404
Hardwood Deciduous Species	2,625	6,508	398	260	23	9,813
Softwood Deciduous Species	290	645	308	100	11	1,354
Total Area of Coniferous and Deciduous Species	3,168	7,915	1,778	617	93	13,570
<i>Share of each column:</i>						
Coniferous Species	8%	10%	60%	42%	64%	18%
Hardwood Deciduous Species	83%	82%	22%	42%	24%	72%
Softwood Deciduous Species	9%	8%	17%	16%	12%	10%
Total Area of Coniferous and Deciduous Species	100%	100%	100%	100%	100%	100%
<i>Share of each row:</i>						
Coniferous Species	11%	32%	45%	11%	2%	100%
Hardwood Deciduous Species	27%	66%	4%	3%	0%	100%
Softwood Deciduous Species	21%	48%	23%	7%	1%	100%
Total Area of Coniferous and Deciduous Species	23%	58%	13%	5%	1%	100%

Source: USSR State Committee for Forestry/cab

TABLE C62

CENTRAL ASIA: Stocking Class - Distribution of Stocked Forest Land Administered By Forest Authorities (including that allocated to long-term uses) By Major Species Group (excluding species not included in one of the three species groups)				
(thousands of hectares)				
	Stocking Class	Stocking Class	Stocking Class	Total Stocked Forest Land
	good	medium	poor	
CENTRAL ASIA:				
Coniferous Species	235	1,137	1,032	2,404
Hardwood Deciduous Species	217	1,702	7,894	9,813
Softwood Deciduous Species	220	852	282	1,354
Total Area of Coniferous and Deciduous Species	671	3,692	9,208	13,570
<i>Share of each column:</i>				
Coniferous Species	35%	31%	11%	18%
Hardwood Deciduous Species	32%	46%	86%	72%
Softwood Deciduous Species	33%	23%	3%	10%
Total Area of Coniferous and Deciduous Species	100%	100%	100%	100%
<i>Share of each row:</i>				
Coniferous Species	10%	47%	43%	100%
Hardwood Deciduous Species	2%	17%	80%	100%
Softwood Deciduous Species	16%	63%	21%	100%
Total Area of Coniferous and Deciduous Species	5%	27%	68%	100%
Source: USSR State Committee for Forestry/cab				

TABLE C63

CENTRAL ASIA: Mountain Forests (excluding forests allocated for long term uses) - Distribution of Stocked Forest Land By Group of Forest and By Principal Species Group						
						(thousands of hectares)
	Total					
	Stocked Forest	Coniferous	Hardwood	Softwood	Other	Brush Species
	Land	Species	Deciduous	Deciduous	Species	Species
CENTRAL ASIA:						
Group 1	1,756	766	61	188	162	579
Group 2	292	126	0	69	0	97
Group 3	686	399	0	166	3	118
Total Mountain Forests in Groups 1, 2, and 3 Forests	2,734	1,290	61	423	165	794
<i>Share of each column:</i>						
Group 1	64%	59%	100%	44%	98%	73%
Group 2	11%	10%	0%	16%	0%	12%
Group 3	25%	31%	0%	39%	2%	15%
Total Mountain Forests in Groups 1, 2, and 3 Forests	100%	100%	100%	100%	100%	100%
<i>Share of each row:</i>						
Group 1	100%	44%	3%	11%	9%	33%
Group 2	100%	43%	0%	24%	0%	33%
Group 3	100%	58%	0%	24%	0%	17%
Total Mountain Forests in Groups 1, 2, and 3 Forests	100%	47%	2%	15%	6%	29%
Source: USSR State Committee for Forestry/cab						

TABLE C64

CENTRAL ASIA: Mountain Forests (excluding forests allocated to long-term uses) - Distribution of Growing Stock By Group of Forest and By Principal Species Group				
	(millions of cubic meters)			
	Total Growing Stock	Coniferous Species	Hardwood Deciduous	Softwood Deciduous
CENTRAL ASIA:				
Group 1	97	75	1	21
Group 2	27	18	0	9
Group 3	73	62	0	11
Total Mountain Forests				
in Groups 1, 2, and 3 Forests	197	155	1	40
<i>Share of each column:</i>				
Group 1	49%	49%	100%	51%
Group 2	13%	12%	0%	21%
Group 3	37%	40%	0%	28%
Total Mountain Forests				
in Groups 1, 2, and 3 Forests	100%	100%	100%	100%
<i>Share of each row:</i>				
Group 1	100%	78%	1%	21%
Group 2	100%	68%	0%	32%
Group 3	100%	85%	0%	15%
Total Mountain Forests				
in Groups 1, 2, and 3 Forests	100%	79%	1%	21%

Source: USSR State Committee for Forestry/cab

TABLE C65

CENTRAL ASIA: Stocked Forest Land (excluding that allocated to long-term uses) - Distribution Under Control of Forest Authorities by Mountain and Non-mountain Category						
and by Species Group and by Age Class						
(thousands of hectares)						
Total Stocked Forest Land	Coniferous Species	Hardwood Species	Softwood Species	Other Species	Deciduous Species	Principle Three Species Groups
CENTRAL ASIA:						All Ages Overmature Less than mature
Mountain Forests	2,734	1,290	61	423	959	1,775
Non-Mountain Forests	5,046	832	2,554	922	738	4,308
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	7,779	2,122	2,615	1,345	1,697	6,082
<i>Share of each column:</i>						
Mountain Forests	35%	61%	2%	31%	57%	29%
Non-Mountain Forests	65%	39%	98%	69%	43%	71%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	100%	100%	100%	100%	100%
<i>Share of each row:</i>						
Mountain Forests	100%	47%	2%	15%	35%	100%
Non-Mountain Forests	100%	16%	51%	18%	15%	100%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	27%	34%	17%	22%	100%
Source: USSR State Committee for Forestry/cab						

TABLE C66

CENTRAL ASIA: Growing Stock (excluding that allocated to long-term uses) - Distribution Under Control of Forest Authorities by Mountain and Non-mountain Category and by Species Group and by Age Class						
(millions of cubic meters)						
Total Growing Stock	Coniferous Species	Hardwood Species	Deciduous Species	Other Species	All Ages	Mature & Less than mature
CENTRAL ASIA:						
Mountain Forests	197	155	1	40	0	197
Non-Mountain Forests	180	82	8	77	13	167
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES						
<i>Share of each column:</i>						
Mountain Forests	52%	65%	14%	34%	0%	54%
Non-Mountain Forests	48%	35%	86%	66%	100%	46%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES						
<i>Share of each row:</i>						
Mountain Forests	100%	79%	1%	21%	0%	100%
Non-Mountain Forests	100%	46%	4%	43%	7%	100%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES						
Source: USSR State Committee for Forestry/cab						

TABLE C67

		PACIFIC ASIAN USSR: Stocked Forest Land - Distribution Among Agencies With Administrative Responsibilities			
		By Species Group			
		(thousands of hectares)			
Total					
Stocked					
Forest	Coniferous	Hardwood	Softwood	Other species	
Land		Deciduous	Deciduous		
PACIFIC ASIAN USSR:					
TOTAL IN THE FOREST FUND	515,016	389,224	13,044	51,609	61,139
Collective Farms	2,936	1,521	49	1,366	0
Government Significant Forests	512,080	387,703	12,994	50,243	61,139
GOV. SIGNIFICANT FORESTS	512,080	387,703	12,994	50,243	61,139
Forest Ministry Forests	493,014	375,859	11,626	45,665	59,864
Forests set aside for other Organizations	19,066	11,844	1,369	4,579	1,275
FOREST MINISTRY FORESTS	493,014	375,859	11,626	45,665	59,864
Forests for longterm uses	27,304	11,570	1,914	764	13,056
Ministry Forests excluding those for longterm uses	465,710	364,289	9,711	44,901	46,809
OTHER MINISTRY FORESTS	19,066	11,844	1,369	4,579	1,275
Government Farm Forests	5,831	2,577	701	2,553	0
Forest Industry Forests	4,996	4,040	0	952	5
Other Ministries	8,239	5,227	668	1,074	1,270
FARM FORESTS	8,767	4,099	750	3,918	0
Collective Farm Forests	2,936	1,521	49	1,366	0
Government Farm Forests	5,831	2,577	701	2,553	0
FORESTS AVAILABLE FOR USE BY FOREST INDUSTRY	470,706	368,329	9,711	45,853	46,813
Ministry Forests excluding those for longterm uses	465,710	364,289	9,711	44,901	46,809
Forest Industry Forests	4,996	4,040	0	952	5

Source: USSR State Committee for Forestry/cab

TABLE C68

PACIFIC ASIAN USSR: Growing Stock - Distribution Among Agencies With Administrative Responsibilities					
	By Species Group				
	(millions of cubic meters)				
	Total	Coniferous	Hardwood	Softwood	Other
	Volume in Forest Fund		Deciduous	Deciduous	Species
PACIFIC ASIAN USSR:					
TOTAL IN THE FOREST FUND	50,572	43,828	1,149	4,239	1,356
Collective Farms	338	218	2	118	0
Government Significant Forests	50,234	43,610	1,148	4,121	1,356
GOV. SIGNIFICANT FORESTS	50,234	43,610	1,148	4,121	1,356
Forest Ministry Forests	47,622	41,557	1,050	3,704	1,311
Forests set aside for other Organizations	2,612	2,052	98	416	46
FOREST MINISTRY FORESTS	47,622	41,557	1,050	3,704	1,311
Forests for longterm uses	1,610	935	171	57	446
Ministry Forests excluding those for longterm uses	46,012	40,622	878	3,647	864
OTHER MINISTRY FORESTS	2,612	2,052	98	416	46
Government Farm Forests	587	340	38	209	0
Forest Industry Forests	1,055	936	0	119	0
Other Ministries	970	775	60	89	46
FARM FORESTS	926	559	40	327	0
Collective Farm Forests	338	218	2	118	0
Government Farm Forests	587	340	38	209	0
FORESTS AVAILABLE FOR USE BY FOREST INDUSTRY	47,067	41,559	878	3,766	864
Ministry Forests excluding those for longterm uses	46,012	40,622	878	3,647	864
Forest Industry Forests	1,055	936	0	119	0

Source: USSR State Committee for Forestry/cab

TABLE C69

		PACIFIC ASIAN USSR: Forest Land - Distribution Under Control				
		Of Forest Authorities (excluding forests allocated to long-term uses) To Groups I, II, and III Forests				
		(thousands of hectares)				
		Total	Stocked Forest Land	Unstocked Forest Land	Plantations Crown not Closed	Plantations Nurseries Other
PACIFIC ASIAN USSR:						
Group 1 Forests		72,386	64,490	7,778	116	3
Group 2 Forests		12,753	11,998	673	82	0
Group 3 Forests		472,083	394,219	77,297	567	1
of which:						
Special Zoned Forests		6,395	4,565	1,826	5	0
Reserve Forests		207,501	169,284	38,212	5	0
Operational Forests		258,187	220,370	37,260	556	1
Total Area of Group 1, 2, and 3						
Forests		557,223	470,706	85,748	765	4
<i>Share of each column:</i>						
Group 1 Forests		13%	14%	9%	15%	68%
Group 2 Forests		2%	3%	1%	11%	8%
Group 3 Forests		85%	84%	90%	74%	24%
of which:						
Special Zoned Forests		1%	1%	2%	1%	0%
Reserve Forests		37%	36%	45%	1%	0%
Operational Forests		46%	47%	43%	73%	24%
Total Area of Group 1, 2, and 3						
Forests		100%	100%	100%	100%	100%
<i>Share of each row:</i>						
Group 1 Forests		100%	89%	11%	0%	0%
Group 2 Forests		100%	94%	5%	1%	0%
Group 3 Forests		100%	84%	16%	0%	0%
of which:						
Special Zoned Forests		100%	71%	29%	0%	0%
Reserve Forests		100%	82%	18%	0%	0%
Operational Forests		100%	85%	14%	0%	0%
Total Area of Group 1, 2, and 3						
Forests		100%	84%	15%	0%	0%

Source: USSR State Committee for Forestry/cab

TABLE C70

PACIFIC ASIAN USSR: Unstocked Forest Land - Distribution Under Control Of Forest Authorities (excluding forests allocated to long-term uses) To Groups I, II, and III Forests					
(thousands of hectares)					
Total	Unstocked	Glades	Burned/killed	Cutover	Open or Wasteland
PACIFIC ASIAN USSR:					
Group 1 Forests	7,778	4,857	2,106	244	571
Group 2 Forests	673	153	228	182	110
Group 3 Forests	77,297	47,716	22,998	3,954	2,630
of which:					
Special Zoned Forests	1,826	1,356	431	10	28
Reserve Forests	38,212	26,536	10,669	136	871
Operational Forests	37,260	19,824	11,897	3,807	1,731
Total Area of Group 1, 2, and 3					
Forests	85,748	52,725	25,331	4,380	3,311
<i>Share of each column:</i>					
Group 1 Forests	9%	9%	8%	6%	17%
Group 2 Forests	1%	0%	1%	4%	3%
Group 3 Forests	90%	90%	91%	90%	79%
of which:					
Special Zoned Forests	2%	3%	2%	0%	1%
Reserve Forests	45%	50%	42%	3%	26%
Operational Forests	43%	38%	47%	87%	52%
Total Area of Group 1, 2, and 3					
Forests	100%	100%	100%	100%	100%
<i>Share of each row:</i>					
Group 1 Forests	100%	62%	27%	3%	7%
Group 2 Forests	100%	23%	34%	27%	16%
Group 3 Forests	100%	62%	30%	5%	3%
of which:					
Special Zoned Forests	100%	74%	24%	1%	2%
Reserve Forests	100%	69%	28%	0%	2%
Operational Forests	100%	53%	32%	10%	5%
Total Area of Group 1, 2, and 3					
Forests	100%	61%	30%	5%	4%

Source: USSR State Committee for Forestry/cab

TABLE C71

PACIFIC ASIAN USSR: Site Class - Distribution of Stocked Forest Land						
Administered By Forest Authorities (including that allocated to long-term uses) By Major Species Group (excluding species not included in one of the three species groups)						
(thousands of hectares)						
Site Class						
	2 and higher	3	4	5	Below 5	Total Stocked Forest Land
All Stocking	All Stocking	All Stocking	All Stocking	All Stocking	All Stocking	
PACIFIC ASIAN USSR:						
Coniferous Species	9,132	104,424	103,259	107,249	55,835	379,899
Hardwood Deciduous Species	233	1,473	2,587	4,879	2,454	11,626
Softwood Deciduous Species	5,634	19,220	13,834	5,787	2,141	46,617
Total Area of Coniferous and Deciduous Species	14,999	125,117	119,680	117,914	60,431	438,141
<i>Share of each column:</i>						
Coniferous Species	61%	83%	86%	91%	92%	87%
Hardwood Deciduous Species	2%	1%	2%	4%	4%	3%
Softwood Deciduous Species	38%	15%	12%	5%	4%	11%
Total Area of Coniferous and Deciduous Species	100%	100%	100%	100%	100%	100%
<i>Share of each row:</i>						
Coniferous Species	2%	27%	27%	28%	15%	100%
Hardwood Deciduous Species	2%	13%	22%	42%	21%	100%
Softwood Deciduous Species	12%	41%	30%	12%	5%	100%
Total Area of Coniferous and Deciduous Species	3%	29%	27%	27%	14%	100%

Source: USSR State Committee for Forestry/cab

TABLE C72

PACIFIC ASIAN USSR: Stocking Class - Distribution of Stocked Forest Land Administered By Forest Authorities (including that allocated to long-term uses) By Major Species Group (excluding species not included in one of the three species groups)				
(thousands of hectares)				
	Stocking Class	Stocking Class	Stocking Class	Total Stocked Forest Land
	good	medium	poor	
PACIFIC ASIAN USSR:				
Coniferous Species	44,844	207,600	127,455	379,899
Hardwood Deciduous Species	1,384	7,092	3,149	11,626
Softwood Deciduous Species	8,688	29,822	8,107	46,617
Total Area of Coniferous and Deciduous Species	54,916	244,514	138,711	438,141
<i>Share of each column:</i>				
Coniferous Species	82%	85%	92%	87%
Hardwood Deciduous Species	3%	3%	2%	3%
Softwood Deciduous Species	16%	12%	6%	11%
Total Area of Coniferous and Deciduous Species	100%	100%	100%	100%
<i>Share of each row:</i>				
Coniferous Species	12%	55%	34%	100%
Hardwood Deciduous Species	12%	61%	27%	100%
Softwood Deciduous Species	19%	64%	17%	100%
Total Area of Coniferous and Deciduous Species	13%	56%	32%	100%
Source: USSR State Committee for Forestry/cab				

TABLE C73

PACIFIC ASIAN USSR: Mountain Forests (excluding forests allocated for long term uses) - Distribution of Stocked Forest Land By Group of Forest and By Principal Species Group						
						(thousands of hectares)
	Total Stocked Forest Land	Coniferous Species	Hardwood Deciduous	Softwood Deciduous	Other Species	Brush Species
PACIFIC ASIAN USSR:						
Group 1	34,881	24,508	2,359	4,897	15	3,103
Group 2	11,228	7,931	822	1,779	2	694
Group 3	195,543	137,885	6,258	18,063	28	33,309
Total Mountain Forests						
In Groups 1, 2, and 3 Forests	241,653	170,324	9,439	24,739	45	37,107
<i>Share of each column:</i>						
Group 1	14%	14%	25%	20%	33%	8%
Group 2	5%	5%	9%	7%	4%	2%
Group 3	81%	81%	66%	73%	62%	90%
Total Mountain Forests						
In Groups 1, 2, and 3 Forests	100%	100%	100%	100%	100%	100%
<i>Share of each row:</i>						
Group 1	100%	70%	7%	14%	0%	9%
Group 2	100%	71%	7%	16%	0%	6%
Group 3	100%	71%	3%	9%	0%	17%
Total Mountain Forests						
In Groups 1, 2, and 3 Forests	100%	70%	4%	10%	0%	15%

Source: USSR State Committee for Forestry/cab

TABLE C74

PACIFIC ASIAN USSR: Mountain Forests (excluding forests allocated to long-term uses) - Distribution of Growing Stock By Group of Forest and By Principal Species Group				
	(millions of cubic meters)			
	Total Growing Stock	Coniferous Species	Hardwood Deciduous	Softwood Deciduous
PACIFIC ASIAN USSR:				
Group 1	4,746	3,979	209	559
Group 2	1,178	983	61	134
Group 3	19,188	16,498	582	2,108
Total Mountain Forests				
in Groups 1, 2, and 3 Forests	25,113	21,460	853	2,800
<i>Share of each column:</i>				
Group 1	19%	19%	25%	20%
Group 2	5%	5%	7%	5%
Group 3	76%	77%	68%	75%
Total Mountain Forests				
in Groups 1, 2, and 3 Forests	100%	100%	100%	100%
<i>Share of each row:</i>				
Group 1	100%	84%	4%	12%
Group 2	100%	83%	5%	11%
Group 3	100%	86%	3%	11%
Total Mountain Forests				
in Groups 1, 2, and 3 Forests	100%	85%	3%	11%

Source: USSR State Committee for Forestry/cab

TABLE C75

PACIFIC ASIAN USSR: Stocked Forest Land (excluding that allocated to long-term uses) - Distribution Under Control of Forest Authorities by Mountain and Non-mountain Category and by Species Group and by Age Class						
(thousands of hectares)						
Total						
Stocked Forest	Coniferous Land	Hardwood Species	Softwood Species	Other Species	Groups	Principle Three Species Groups
PACIFIC ASIAN USSR:					All Ages	Mature & Overmature
Mountain Forests	241,653	170,324	9,439	24,739	37,151	204,502
Non-Mountain Forests	229,054	198,005	272	21,114	9,662	219,391
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	470,706	368,329	9,711	45,853	46,813	423,893
<i>Percent of column:^a</i>						
Mountain Forests	51%	46%	97%	54%	79%	48%
Non-Mountain Forests	49%	54%	35%	46%	21%	52%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	100%	100%	100%	100%	100%
<i>Percent of row:^b</i>						
Mountain Forests	100%	70%	4%	10%	15%	43%
Non-Mountain Forests	100%	86%	0%	9%	4%	64%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	78%	2%	10%	10%	54%
Source: USSR State Committee for Forestry/cab						

TABLE C76

PACIFIC ASIAN USSR: Growing Stock (excluding that allocated to long-term uses) - Distribution Under Control of Forest Authorities by Mountain and Non-mountain Category and by Species Group and by Age Class						
						(millions of cubic meters)
Total Growing Stock	Coniferous Species	Hardwood Species	Deciduous Species	Other Species	Principle Three Species Groups	Mature & Less than mature
PACIFIC ASIAN USSR:						
Mountain Forests	25,113	21,460	853	2,800	0	25,113
Non-Mountain Forests	21,954	20,099	26	966	864	21,090
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	47,067	41,559	878	3,766	864	46,203
<i>Share of each column:</i>						
Mountain Forests	53%	52%	97%	74%	0%	54%
Non-Mountain Forests	47%	48%	3%	26%	100%	46%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	100%	100%	100%	100%	100%
<i>Share of each row:</i>						
Mountain Forests	100%	85%	3%	11%	0%	100%
Non-Mountain Forests	100%	92%	0%	4%	4%	100%
FORESTS ADMINISTERED BY THE FOREST AUTHORITIES	100%	88%	2%	8%	2%	100%
Source: USSR State Committee for Forestry/cab						

APPENDIX D

GLOSSARY

Glossary

Administered by the forest authorities - While nearly all of the forest resource is owned by the government, the management of it has been delegated to different agencies. The forest authorities include *Goskomles* and the forest industry. This term is synonymous with "under control of forest authorities".

Allowable annual cut (AAC) - The forest resource supports an allowable annual cut which reflects the maximum volume of harvest that can be sustained over the long-term. The AAC does not include harvest from "intermediate utilization" or "other utilization". It only includes the harvest under "principal utilization".

Approaching maturity - There are six age classes of forested land. This the third youngest age class which occurs at an age between 80 and 100 years for conifers and hardwood deciduous tree species and between 50 and 60 years for softwood deciduous species.

Asian USSR - The Soviet Union has been divided into four major regions. The Asian USSR includes the three non-European USSR regions: "Transition RSFSR", "Pacific Asian USSR", and "Central Asian USSR". The Asian part of the USSR includes the following republics plus the part of the Russian republic east of the Ural mountains. The regions included in the Russian part are West Siberia, East Siberia, and The Far East. The republics are Kirgiz, Tadzistan, Uzbekistan, Turkmenistan and Kazakhstan.

Burned/killed - This is a category of "unstocked forest land". It refers to forested area which has been subjected to fire and no longer supports the minimum stocking to be considered "stocked forest land".

Central Asian USSR - The Soviet Union has been divided into four major regions. This region corresponds to the five Central Asian republics: Kirgiz, Tadzistan, Uzbekistan, Turkmenistan and Kazakhstan.

Collective farms - There are two types of organizations for the production of agricultural products: collective farms and government farms. Collective farms are thought to have no direct government involvement in the day to day operations and are considered some what independent of government management.

Coniferous species - The species included in this group are: larch, pine, cedar pine, spruce, true fir, and juniper. Refer to "species groups" for more information.

Cutover - This is a category of "unstocked forest land". It refers to forested land which has been harvested and does not yet support another crop of trees.

European USSR - The Soviet Union has been divided into four major regions. The European Part of the USSR includes the following republics plus that part of the Russian Republic located west of the Ural mountains. The republics are Latvia, Estonia and Lithuania, Moldavia, Belorussia and the Ukraine, Georgia, Azerbaijan, and Armenia.

Exploitable forests - These forests are the sub-set of "operational forests" which exclude low site forest land and forest land which supports non-commercial species generally belonging to the "other species group". In addition, reserve forests, special zoned forests, and forests in which harvesting conflicts with the primary use are also excluded.

Forest fund - The forest resource of the USSR is accounted for through the Forest Fund. This is an administrative designation for all land which has use for the forest economy or forms part of the mosaic within the land base which contains the majority of the forest resource. The categories of land include general land, forest land, stocked forest land, and unstocked forest land.

Forest Group - The forests of the Soviet Union are managed for multiple-use. To facilitate their management, the forests have been divided into three categories of forest depending on their location and primary purpose. The categories are Group I, Group II, and Group III forests. Operating forests are presently developed or are expected to be developed within the course of the next two decades.

Forest industry forests - A small share of the forest land is under the direct administration of the forest industry. This forest resource is distinct from the forest resource managed by the forest ministry.

Forest land - This category of land is within the forest fund on which it is possible to grow, and has been set aside, to grow tree species. Forest land includes "stocked forest land", "unstocked forest land", "plantations in which the crowns have yet to close", and "plantations used for nurseries and other" silviculture uses.

Forest Ministry - *Goskomles* or the State Committee for Forestry is a federal organization with counterpart organizations within the individual republics. Responsibilities include research, forest protection and monitoring of the allowable annual cut.

Forested land - This is another term for "stocked forest land".

Forests available for use by the forest industry - This category of the forest resource includes "forest industry forests" and forests managed by the "forest ministry" excluding those allocated for long-term uses.

General land - This represents the total land area accounted for in the "forest fund". The general land area includes forest land and non-forest land such as swamps, deserts, water, and cultivated land.

Glades - This is a category of "unstocked forest land". It refers to small openings in the forest canopy.

Goskomles - State Committee for Forestry or the "Forest Ministry".

Government farms - There are two types of organizations for the production of agricultural products: collective farms and government farms. "Government farms" are directly managed by representatives of the government with allocation of production determined by governmental fiat.

Group I forests - Group I forests have the greatest restrictions on use and are allocated mainly for protection of the environment.

Group II forests - Group II forest, which have both protection and industrial importance, are located in densely populated areas with a well developed transportation network. A greater degree of management is necessary in these forests to guarantee the continued supply of both industrial products and environmental protection functions than is the case in Group III forests below.

Group III forests - Group III forests are generally located in the well forested regions and are chiefly designated to provide a flow of wood to support the forest industry of the Soviet Union without causing damage to the makeup of those forests. Group III forests are classified as either reserve forests or operating forests.

Growing stock - "Stocked forest land" supports a standing inventory of trees. The volume corresponding to this inventory is called the "growing stock".

Hardwood deciduous species - The species included in with this group include oak and beech. Refer to "species groups" for more information.

Industrial harvest - Not all of the "wood harvest" has industrial use. A portion of the harvest (amounting in recent years to approximately 22 percent of the total harvest) is considered firewood. "Industrial harvest" is that portion of the "wood harvest" which excludes firewood.

Intermediate utilization - The wood from lands managed by the "forest authorities" is produced under what is termed either "principal utilization", "intermediate utilization", or "other utilization". Intermediate utilization occurs in all groups of forests and includes stand improvement, thinning, and sanitation fellings.

Less than mature - There are six age classes of "forested land". Two of the age classes are mature and overmature. "Less than mature" refers to the forest resource which is classified as "young class I or II", "middle aged", and "approaching maturity".

Long-term uses - This term is related to non-timber producing activities and usually refers to forest land which supports sub-marginal inventory. The uses include reindeer herding.

Mature/overmature - There are six age classes of "forested land". Two of the age classes are mature and overmature. Maturity is reached when "coniferous species" attain an age of between 80 and 140 and "hardwood deciduous species" attain an age of between 80 and 140. "Softwood deciduous species" reach maturity at ages of 40 to 70. The onset of over maturity is generally considered to occur in conifers when age is between 100 and 140. In "softwood deciduous species", the onset of over-maturity takes place at the age of between 50 and 70. The onset of over-maturity in "hardwood deciduous species" seems to occur much later.

Middle aged - There are six age classes of "forested land". This the third youngest age class which occurs at age between 40 and 60 for coniferous and "hardwood deciduous tree species" and at between 20 and 30 for "softwood deciduous species".

Mountain forests - Mountain forests grow within the mountain regions where relative elevation differences are greater than 100 meters or an average slope surface from lowlands to the mountain top or to the tree line is greater than 5 degrees.

Non-forest administration - The forest resource of the Soviet Union is allocated to different agencies and organizations for the purpose of administration and management. Non-forest administration excludes the State Committee for Forestry and organizations of the forest industry. Non-forest administrations include the Ministry of the Interior, Ministry of Defence, Education ministry, and Agricultural ministries.

Non-mountain forests - This term refers to forests which do not belong to "mountain forests".

Open/wasteland - This is a category of "unstocked forest land". It refers to extended areas of unstocked forest land larger than the category "glades".

Operational forests - These forests are a sub-set of "Group III forests". "Operational forests" denote the area which is potentially available for unrestricted timber harvest. Not all of the "operational forests" are exploitable however.

Other ministries - The term captures other ministries than the forest ministry which have management responsibility for parts of the forest resource.

Other species - The forest resource included in this group is not large and amounts to approximately 5 percent of the forest resource. Refer to "species groups" for more information.

Other utilization - The wood from lands managed by the forest authorities is produced under what is termed either "principal utilization", "intermediate utilization", or "other utilization". "Other utilization" is thought to occur in Groups I, II, and III forests mainly in response to industrial development.

Outside of plan - Up until recently, the economy of the Soviet Union was centrally planned. How much to produce, what to produce, and where to send it were generally determined by central authorities in Moscow. The production which was produced using resources not specifically identified in the plan was called production "outside of plan".

Pacific Asian USSR - The Soviet Union has been divided into four major regions. This region corresponds to the East Siberian region and the Far East region of the Russian republic.

Plantations : crowns not closed - This is a category of forest land which is neither unstocked nor stocked. A second crop of trees has been artificially established; but the plantation development is not sufficiently advanced to be considered stocked at the present inventory date.

Plantations : nurseries and other - This is one category of forest land which has been set aside for nursery purposes, to grow seedlings, produce seeds, etc.

Potentially and currently accessible - The forest resource that is available for exploitation by the forest industry is called "potentially and currently accessible". The part of the forest resource which either is presently accessible or is expected to be within 150 to 200 kilometers of a major transportation network in the next 15 to 20 years is considered "potentially and currently accessible".

Principal utilization - The wood from lands managed by the forest authorities is produced under what is termed either "principal utilization", "intermediate utilization", or "other utilization". "Principal utilization" is conducted largely in mature stands, primarily in Group III forests with some occurring in Group II forests.

Reserve and inaccessible - The forest resource is not all available for exploitation by the forest industry. The part of the forest resource which is either not expected to be within 150 to 200 kilometers of a major transportation network in the next 15 to 20 years or for which there are values which effectively preclude harvesting are considered "reserve and inaccessible".

Reserve forests - These forests are a sub-set of Group III forests. Reserve forests have not yet been assigned to an industrial enterprise and are not expected to be economically developed for the next 15 to 20 years.

Roundwood harvest - The trees which are logged from the forest resource are collectively called "the roundwood harvest".

Site class - The forest land is divided into five site classes ranging from 1 (the highest site) down to 5 (the lowest site). In addition to the five site classes, there are two gradations beyond site class 1 and two gradations below site class 5. In the Soviet literature, subscripts a and b denote the sub classes. Thus, site classes 1a and 1b would denote forest land which has an even higher site quality than that depicted by site class 1. Correspondingly, site classes 5a and 5b denote site classes which are even poorer than those classified as 5. Site class 5b is a lower site class than 5a. Correspondingly, site class 1b is higher site class than 1a.

Softwood Deciduous species - The species included in this group are: birch, aspen, and basswood. Refer to "species groups" for more information.

Special zoned forests - These forests are a sub-set of both "Group II" and "Group III forests". Special zoned forests are believed to be located in accessible parts of the forest domain but where additional restrictions on use has been placed to account for either environmental, aesthetic, or historical values.

Species groups - The forest inventory is divided into three main groups based on which broad association individual species belong to. The species groups are: "coniferous species", "hardwood deciduous species", and "softwood deciduous species". The three species groups do not account for all of the forest resource. In addition, a small amount is accounted for by a classification called other species. The other species could belong to either of the three species groups; but due to small volumes and area, are accounted for through the fourth group called other species.

Stocked forest land - This is a category of "forest land" which supports trees which either have a basal area at least 30 percent of the 'normal' basal area for the type of stand or supports a stand of trees for which the crown closure is at least 30 percent of normal.

Stocking class - Stocking class divides the forest inventory into three categories based on the degree of stocking. Stands are considered fully stocked when there is 100 percent crown closure. Stands under these conditions are given a stocking class of 1.0. Stands in the Soviet Union are considered stocked when crown closure is greater than 30 percent. There is another criterion used to determine the degree of stocking. Apparently, stocking is also based on the extent to which the basal area of the stand currently occupying the site approaches that which is considered the normal basal area. Thus, if the current stand had a basal area 80 percent of the normal, it would be classified as having a stocking class of 0.8.

The stocking classes are defined as high, medium, and low stocking, which incorporate the range of stocking between 30 percent and 100 percent. The high stocking class corresponds to crown closure of between 80 and 100 percent. The medium stocking class corresponds to crown closure of between 50 and 70 percent. The low stocking class corresponds to between 30 and 40 percent.

Transition RSFSR region - The Soviet Union has been divided into four major regions. This region corresponds to the West Siberian region of the Russian republic.

Under control of forest authorities - While nearly all of the forest resource is owned by the government, the management of it has been delegated to different agencies. The forest authorities include *Goskomles* and the forest industry. This term is synonymous with "administered by the forest authorities".

Unstocked forest land - This is a category of "forest land" which does not meet the minimum criteria delineated in "stocked forest land".

Wood deliveries - The "roundwood harvest" is distinct from the "wood deliveries". While the literature is often not clear on this, the "roundwood harvest" becomes "wood delivers" when it reaches either point of utilization or point of transference to a major transportation system.

Wood harvest - This term corresponds to "roundwood harvest".

Young class I - There are six age classes of forested land. This is the youngest age class which extends from 10 to 25 years depending on the species.

Young class II - There are six age classes of forested land. This is the second youngest age class which extends from 25 to 40 years depending on the species.