# THE PRIVATE DEMAND FOR STATE LAND:

# A FORECAST FOR 1981-1985

Prepared for

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# Introduction

This paper presents a forecast of the private demand for state land for the years 1981-1985. The primary purpose of this paper is to illustrate a method suggested for assessing this demand. The discussion of this methodology and forecast is intended to provide the Department of Natural Resources (DNR) with a tool for use in planning. The method examined makes use of information from past land sales to estimate demand equations. This method is one of several suggested in a previous report (see Huskey, 1980). The main strengths of using this method are the richness of available information and ease of application. This paper describes both the steps taken in applying the method and the resulting projections.

This application should only be considered a preliminary effort. Because of this, improvements and changes are suggested, along with the description of the approach and results. These suggestions are part of an overall description of the steps that DNR must take to implement this methodology. The projections described below will be subject to change as the methodology is improved and additional information becomes available.

The refinement of the methodology and the accompanying change in projected levels of demand are natural steps in any modeling process. There are three reasons for this which relate to this particular application. First, modeling is an evolutionary process. We learn by

doing, so that through the use of models, we continue to find ways to refine and improve the models we use. Secondly, with each additional state land sale, we will find out more about the demand for land. Each sale provides additional information on state residents' preferences for types of land. This additional sales information will help to reduce the effect of any peculiarities which may be inherent in the analysis of the first-time sales examined in this report. Finally, the application by DNR staff will improve the methodology. Because of their daily interaction with state land, the staff will be able to fine tune the method to better reflect the realities of the disposal program.

In addition to its use in planning, the approach described in this paper also provides a useful management tool. The efficient application of the forecast methodology requires that a systematic record-keeping system be established. Analysis of the determinants of demand defines the dimensions of this record-keeping system. Once implemented, the record system can be used, not only for forecasting but in the analysis of the success of past sales and the selection of parcels for future sales.

## The Existing State Land Disposal Program

The existing state land disposal program was defined by legislation adopted in 1978 and 1979. Prior to 1978, the state disposal of land was not the result of explicit policy. The Alaska Land Policy Act adopted in 1978 provided the basis for state land planning and

disposal. This legislation required land use decisions to be based on a resource inventory and land classification system. The second major piece of legislation affecting the disposal program was the adoption of a legislative mandate in 1979 to dispose of 100,000 acres per year; the mandate was the result of the perception of large, unmet private demand for land.

Under this legislation, the state disposes of land through a variety of programs. Two disposal methods are auction and lottery. Under the lottery system, residents apply for specific parcels of land with a set price; parcels are allocated by drawing winners in a state-wide lottery. The programs, including agricultural, homesite land, subdivision, and remote parcel, cover a number of specific types of land and specific uses which have specific conditions on their use.

State programs also operate under special conditions which limit their substitution with private land markets. The most important of these conditions deals with residency. One-year residency in the state is required to participate in the program. The parcel price also changes as a function of length of residency. In addition, residents are limited in the number of times they can win in land lotteries. Residents are allowed to purchase a parcel by lottery only once every eight years in the subdivision or remote parcel program and once for homesites.

The disposal program resulting from this legislation is the basis for the analysis in this paper. Specifically, we will examine the

private demand for state land as it was reflected in three state land lotteries. These lotteries were held in the fall of 1979 and in the spring and fall of 1980. We examine the demand in three of the four types of lotteries: subdivision, homesite, and remote. The method could easily be extended to the agricultural lotteries which were left out. The results in this paper can be interpreted as a description of the demand for residential and recreational land.

The forecast presented in this paper is contingent on the existing disposal program. The demand reflected in the state's three most recent sales reflects the conditions and restrictions of the present system of disposals. Because of this, the results of this study cannot be assumed consumers' responses to major changes in the land disposal program.

The remainder of the paper is in three parts. The first of these provides the framework for the empirical analysis of the private demand for state land. The second describes the empirical methodology selected for projecting the private demand for land facing the state land disposal program. This section also provides a forecast of the demand for land between 1981 and 1985. The final section of the paper examines the future use of this methodology by DNR.

## Definition of the Question

The purpose of the research described in this paper was to assess the demand for state land. This section will examine this question.

Two aspects of the question must be examined to provide the necessary framework for the methodology and forecast described in the following section. The first aspect of the question concerns its policy relevance; the second concerns the limits and constraints which are necessarily imposed on the definition of demand. Descriptions of each of these aspects reflect a specific theoretical understanding of land demand and land markets.

## Policy Relevance

Although the reason may not be evident, a better understanding of the demand for land is needed to effectively allocate state land. The state's large land holdings may make it seem that state land is in unlimited supply (relative to demand) and that its allocation is not an economic problem. Under an assumption of unlimited supply, land disposal would simply make large amounts of land available for private ownership as quickly as possible.

The allocation of state land, however, is an economic problem. The large size of state land holdings is tempered by the fact that only a portion of this land is of the quality and location to be used for residence and recreation (Northern Resource Management, 1980). In addition, the demand for land may be quite large when considered in its fullest definition. The perception of a large unmet private demand for land was behind the 100,000 acre quota. In addition, there are other types of land uses which could occupy the limited supply of good quality land. Public uses such as parks, watersheds, and fish and game reserves compete with private uses. In addition, other

private uses such as agriculture and extractive uses are also in competition for land. The supply of usable land may be relatively limited once its quality dimensions and alternate uses are considered. This makes the allocation of state land an economic problem. To properly allocate this land, a better understanding of both the demand for private residential and recreational use of state land and the supply of state land is needed.

## The Definition of Demand

Demand is a term which is often misunderstood in its policy applications. Much of the confusion, contradiction, and controversy surrounding the land disposal program may result from a misunderstanding of this term. This section will briefly examine the economic definition of demand. An understanding of this definition is important since this defines the concept we are projecting. Our goal in examining the definition of demand and its relationship in land markets is to determine the limits and conditions which must be placed on any forecast of the private demand for state land.

Demand defines the relationship between the quantity of a good purchased and the price paid for it. Demand is usually represented by a demand schedule or demand curve; this schedule shows the maximum amount of the good a group of consumers would purchase at each specific price.

The demand for a good is a function of the price of the good, the consumer's income, and the price of other goods and services. Given

the prices and income, an individual allocates his income among alternative goods to maximize his satisfaction. While the effect of changes in the price of the good is reflected by the demand schedule, changes in other determinants result in movements in the schedule. The quantity demanded can only be defined in terms of a specific set of incomes and prices.

This analysis points out one important condition on a forecast of land demand. Demand must be defined in relation to price. The quantity demanded of a product cannot be defined except in terms of a particular price. Price from the consumer's point of view is the full cost of purchasing the product. The price which affects demand may differ from the purchase price. The price may be subsidized so that the actual cost of purchase will be less than the purchase price. The discount system, which allows residents to subtract up to 50 percent of the purchase price as a function of length of residency, is a subsidy which distinguishes the cost of purchase from the offer price. Costs of purchase may also be greater than the purchase price. Purchase of a parcel of land may include additional costs such as interest, taxes, and the travel costs to use the parcel. All of these factors affect the cost of purchase; it is the full cost of purchase which determines the quantity demanded, not simply the market price.

Land as a Commodity. The markets for land have certain unique characteristics which must be reflected in any forecast of future demand. This section describes the unique character of this market. This discussion will help to further define the limits and conditions

which must be reflected in the projection of the demand facing the state's disposal program.

Land is a unique commodity which differs from other traded goods and services. There are three important differences. First, unlike most commodities, land is a commodity to which people travel to consume. This means travel costs are an important component of the cost of consuming land and must be included with the purchase price in the cost of purchasing land. Second, land is durable and extremely costly to produce, which means that the supply or the stock of land is very inelastic (little new land will be made available with an increase in the price people are willing to pay). Finally, the land is not a homogeneous commodity; land parcels differ in many important dimensions.

Land is not one commodity; it is a series of commodities which are close but not perfect substitutes. This aspect of land markets can be seen by describing land by the characteristics it possesses. Differences in important characteristics distinguish types of land; such characteristics are the public and private improvements associated with a parcel, the environmental and physical characteristics (e.g., view and topography), and the size. Purchase of a parcel of land also buys a location which determines another set of characteristics associated with it. These include the access to public services provided by government, taxes, and regulations. Location also determines the transport costs from a parcel to employment and other activities.

The combination of heterogeneity of types, the durability of land, and its locational aspects mean the land market is a series of closely related, but segmented, markets. Separate markets exist for different types of land, distinguished by the characteristics of the parcels. Market segmentation occurs because of the existence of supply restrictions on some attributes. Supply restrictions result because certain attributes cannot be reproduced (the view from a parcel); this fact separates land types. There is also segmentation on the demand side of the market: potential purchasers of land limit their market examination to certain areas because of familiarity or locational constraints. This also segments the market.

The demand for land also differs from other commodities. The demand for land is a derived demand. Land is used in the production of other products such as agricultural products, residences, and recreational homes. The demand for land is determined by the demand for these other products. The demand for land is really the demand for a factor of production which reflects the demand for the final product, the production technology, and the supply of complementary inputs. Because land can be used in various proportions to produce final products, demand for land is not necessarily directly proportional to the demand for the final product. For example, housing services may be produced on lots of varying sizes so that increases in the demand for housing services will not necessarily reflect a proportionate increase in demand for land.

Although the demand for land is determined by its usefulness in producing other products, the demand has an important time component. The demand for land at any point in time includes the demand determined by current use and the demand determined by its future use potential: the demand for use and investment demand. The use demand is a function of the productivity of land in alternative uses. Investment demand is based on potential future uses; one important determinant is future expected prices. Estimates of changing conditions and land characteristics will influence the expectation about future land markets and the investment demand for land.

Within each separate land market, the price of land and the quantity of land consumed are determined by the interaction of the supply and demand schedules. The supply of land, like the demand, is unique. The supply of land is not the total available stock of vacant land. Supply differs from the stock of vacant land for two reasons. First, some of the vacant land is publicly owned and not available for private use. Second, and more important, is that land is held off the market. Each private land owner has a reservation price, below which his land will not be sold. The determination of the reservation price is primarily an investment decision; the reservation price is determined by what the land owner expects the future price of the land to be and his cost of holding the land. The supply of private land is described by the amount offered at each reservation price.

Conditions on the Forecast

The previous discussion serves two purposes. First, an understanding of land as a commodity and how land markets work will allow us to isolate the major determinants of demand for land. Tracking the changes in these determinants will be a basic part of the forecasting methodology. Secondly, the previous discussion points out the limits to what we can forecast. This section summarizes those limitations and the conditions we must place on our projection.

The primary limitation on our forecast is that we cannot describe the quantity of land people wish to purchase independent of some idea of the supply of land. This is a problem economists refer to as the identification problem. The nature of a demand schedule reflects the fact that the quantity of a good consumed (or purchased) in any period varies with the price. For most goods, the quantity demanded at a zero price will be larger than the quantity demanded at a very high price.

Supply of land can be defined in terms of three important dimensions: the type of land, its price, and its location. Land is not one single commodity, but it is a series of closely related commodities. Both supply and demand vary across the different types of commodities. The supply of any type of land represents the amount offered on the market at a given price. Variation in the price at which land is offered will affect the supply of land independent of any change in the stock of land available. Finally, the location of the land influences the supply. The land's location may be an important factor

determining its type; two parcels which are similar in all respects except that one parcel is located in downtown Anchorage and one in Anderson are different types of land. More importantly, the location of the land affects the cost of purchasing it; the location of the parcel determines the travel cost associated with use of the land.

The quantity of land demanded in any year depends on the supply available. This fact limits our ability simply to forecast a demand for land which ignores the type and location of available state land and the price at which it is offered. Because of this, our forecasts must be contingent on some assumed description of available state land.

The Relative Demand for Land

In addition to defining the conditions on any forecast of the demand for land, the preceding discussion may also explain what seems to be a contradiction concerning the demand for land. The land disposal program, especially the establishment of the 100,000-acre quota, was partially predicated on the perception of a large demand for land. In spite of this perception, there are indications that the demand for land is not so great as perceived. This section will describe some of these indications and will offer some explanation of the possible reasons for the contradiction between the perception of a "large" demand for state land and examples of limited demand for state land.

Experience with past state land disposals provides the major reasons for questioning the perception of a large demand for state

land. In the first three land sales, only 43 percent of the subdivision parcels, 72 percent of the homesites, and 85 percent of the remote parcels offered have been sold. In addition, state experience has led to an assumption that about 40 percent to 50 percent of remote parcel land on which parcels were issued will actually be staked (Melke, 1980). This supports the experience with older state sales which have seen little development or use. Gee has shown that of the 519 acres sold in Ketchikan since 1963, sixty-eight percent remain vacant (Gee, 1979).

Although these are only scattered examples, they seem to contradict the perception of a high level of demand. There are several explanations of this apparent contradiction between perceptions of demand and actual behavior. Our discussion of land markets can be used to show the two are not necessarily inconsistent. One explanation, which is independent of the previous discussion, relates to the newness of the program. The state disposal program presents a major change in the structure of land markets. Low participation may simply be a function of the necessary adjustment to this structural change.

The examination of land markets also points out three factors which could explain the existence of a high perceived demand, a low participation in the state's disposal program, and limited use of previously offered land. The first reason which may reconcile high demand with the limited use of past land sales is the different types of demand. Investment demand may be an important component of the overall demand for land. Exchange of land to meet this demand would

not result in the use of the land, but simply change the holding of land from state to private hands. A second factor which may explain the perception of high demand is the effect of price. As we discussed, the quantity demanded depends on the price. Price is determined by the interaction of supply and demand; the state, by adopting the market value as the offer price, supports the workings of the land market. If land is a normal good, the quantity demanded will increase as the price is lowered. At some price below the market value, there will, by definition, be excess, unmet demand. The final and most important reason for the contradiction is that land is not a single commodity; undeveloped subdivision land in the Interior is not the same commodity as land in Anchorage. Because these segmented markets for land exist, high demand for certain types of land will not mean there is high demand for all types of land. If land offered by the state is not the type in demand, the contradiction will exist.

## The Demand for State Land

This section provides a forecast of the private demand for state land. In addition to the actual projections, the methodology used to develop these projections is discussed. The results of this section serve as the basis for suggestions made for the implementation of a demand assessment technique by DNR.

The method chosen to provide this forecast is the sales technique which makes use of information on land demand provided in past land

disposal lotteries. This technique makes use of past lottery information to estimate demand schedules for various types of land. The resulting demand schedules can be used to project the future private demand for state land.

The sales technique was one of nine approaches for assessing the demand for land which had been suggested (see Appendix A for a brief description of these alternative techniques). The selection of the sales technique was made by comparing the ease of implementing the approach and its probable accuracy in describing the workings of land markets. The ease of implementation involves both the cost and timeliness of the approach. Unlike many of the other techniques, the sales technique assured a reasonable degree of accuracy for a low cost. The low cost was primarily a function of the fact that a large portion of the information required was collected as part of the land disposal program. In addition, information to update the methodology would be available at relatively low cost when additional lotteries are held. Timeliness was also a function of available information. Other reasonably accurate methods required a survey which, in addition to being costly, required a great deal of time. Because the disposal information was available, a preliminary estimate of demand could be made with only limited data collection.

The probable accuracy of the sales technique was hypothesized because it could be used to describe demand and the sales data describe actual behavior. Most data on Alaska land markets describes consumption, the quantity purchased under existing conditions of

supply. Because the land disposal program changes the structure of supply, a technique which could be used to assess the effect of a change in supply of land is needed. The state land disposal program provides the information to assess demand and allows us to examine the effect of changing supplies. The primary feature of the disposal program which allows this is the lottery system, which allows us to see the total demand for a parcel and not simply that the parcel was purchased. Total demand is represented by the number of applicants. The second feature of the sales information which suggested it would provide an accurate description of land markets was that it described behavior. The land sales information is behavioral data describing how people actually responded to a given situation. The alternate form of data is attitudinal data which describes how respondents would react in a situation. Behavioral data has the advantage that actions are actually in response to real constraints on income and time and not simply to contingencies as in attitudinal data.

The major weaknesses of using this sales technique relate to the interpretation of the data. First, rules limiting the use of the program to once every eight years make interpretation of the time dimension represented in this information hard. There is a question of whether sales data represent a yearly or one-time demand. The second problem has to do with the structural change brought to the land market by the program. The newness, importance, and nonmarginal nature of the change in the structure of land markets resulting from the initiation of the disposal program may make the initial response

unrepresentative of demand. The bias may be either an under-representation, because of the necessity of learning, or an over-representation, because of a land-rush mentality which accompanies a new program. The final problem in the description of demand can only be made in the context of the existing program. Changes which depart to a large extent from the existing program cannot be examined with this technique.

## The Determinants of the Demand for Land

One check on the potential accuracy of a forecasting methodology is its theoretical adequacy; the forecasting model must be consistent with a view of the way the world works. In this case, the forecasting model must reflect the special characteristics of land markets which were described above. This section will review the major determinants of the private demand for state land. The forecasting model can be assessed by how accurately it reflects these determinants.

The forecasting model describes the relationship between land demand and the determinants of demand. The forecast of land demand depends on a forecast of a change in each determinant. Because of this, the selection of the determinants to include in the model must also be built around determinants which can be easily projected.

The task of this study is to forecast the aggregate demand for land, the demand generated by the entire population. The demand for land is, in reality, determined at the household or individual level. Aggregate demand is simply the sum of the individual demand for land.

The individual's demand for land, like the demand for all goods, depends on the individual's income, the cost of purchasing the land, and the cost of other commodities. Land demand differs from the demand for most consumer goods since it is a derived demand. People desire land, not because it satisfies their needs directly, but because it can be used to produce something they desire. Land is demanded because it can be used to build a home or a recreation cabin. The demand for land depends on the demand for this final good.

Examining the demand for land as a derived demand provides an insight into the importance of different types of land. Different types of land are more productive in certain types of uses. For example, land with access to roads and communities may be better for a residential use than land without these attributes. These same characteristics may not be important for recreational use, while environmental characteristics such as view or lake frontage may be important. Different types of land can be described by differences in the characteristics of the land. These differences affect demand because they affect the productivity of the land. Because of this relationship, the characteristics of the land become an important determinant of demand.

The cost of purchasing the land is also a major determinant of demand. The cost of purchasing the land is really the cost of using the land. The two major components of the cost of using the land are the price and travel cost. Travel cost is not simply the money cost of travel; it also includes the cost in terms of time cost in travel.

Travel cost will be a function of three things. Travel costs depend on the distance traveled in using the land; travel will be from home to the land if it is used for recreation and home to place of employment if it is used for a residence. Another factor determining travel cost is the number of trips made; if the site is used for recreation, travel costs depend on the number of times the site is used. Finally, travel costs depend on the mode of travel. Travel costs for a car or plane differ; the mode used depends both on the distance traveled and the accessibility of the site.

In reality, the price of all other goods and services will affect the demand for land. The set of prices the consumer faces will determine how he allocates his income among land types. A reasonable assumption is that individuals allocate their income in two steps. First, they allocate between all other goods and land, and then they allocate between types of land. With this assumption, the major substitutes which will determine the demand for a type of land will be the cost of purchasing other types of land.

A final determinant of the individual's demand for land is the individual's taste. Taste describes how an individual values land, or the services produced by it, relative to other commodities he could consume. Although tastes cannot be directly observed, they are usually assumed to reflect the individual's socioeconomic status, which is defined by characteristics such as age, education, and family size.

An important dimension of taste in the demand for land is reflected in how individuals plan to use the land. A survey conducted by DNR of the winners in the 1979 Fall lottery shows that these winners had a number of different uses in mind. The three most important uses were recreation (42 percent of the respondents), residence (22 percent of the respondents), and investment (13 percent of the respondents).

The importance of this difference in potential use is that the effect of the determinants isolated above will differ across different uses. For example, for an individual who demands land for investment, distance between his home and the land will not be important; but the distance, because it affects the cost of using the land, will be important for a recreational user. We would also expect the demand for each of these uses to change differently over time.

Aggregate demand is found by summing individual demand over the population and across types of land. Aggregate demand is influenced by more than simply the size of the total population. If tastes vary across socioeconomic groups, the growth of the population in these groups is important. One important socioeconomic group which should be given special consideration is the transient population. This group comes primarily to work with no real plans to stay in Alaska. It could be hypothesized that their demand would be much lower than the rest of the population. In addition to the socioeconomic makeup of the population, the location of the population is another important dimension of population growth. The location of the population

determines the supply of land available to the residents. One dimension of location which cannot be overlooked is the potential effect of the availability of state land on location. Many jobs in Alaska do not require location near the source of employment. These include seasonal or shift work such as construction or petroleum-related employment. The availability of homesites would allow individuals employed in these jobs to locate in any area of the state.

Bounds on the Private Demand for State Land

This section examines two forecasts of the private demand for state land which reflect reasonable bounds on that demand. We will also make use of information from past state sales to narrow the most probable range of future demand. Our extreme forecasts depend on a projection of the population and assumptions about the purpose of the state program. By examining the effect on demand of changes in the major determinants isolated above, we begin to narrow the range of most probable levels of demand.

A forecast of the aggregate demand for land depends on a projection of the growth of population, since population is the major determinant of the aggregate demand for land. Table 1 presents the population projections on which the land demand forecasts throughout this report are based. Two projections are provided which describe a rapid growth scenario (with Major Projects) and a slower growth scenario (without Major Projects). Population growth is projected for the state and seven major subregions.

TABLE 1. POPULATION GROWTH BY REGION, 1980-1985[1]

| | Anchorage | Kenai[3] | Mat-Su | Valdez | Fairbanks[4] | Southeast[5] | Other | State |
|---|---|---|---|---|---|---|---|---|
| With Major Projects[2] | | | | | | | | |
| 1980 | 173,017 | 35,221 | 17,766 | 8,348 | 66,283 | 53,794 | 46,054 | 400,481 |
| 1981 | 179,600 | 35,765 | 18,072 | 8,536 | 68,429 | 53,551 | 46,197 | 410,148 |
| 1982 | 186,470 | 36,751 | 18,383 | 8,729 | 71,947 | 53,308 | 46,485 | 422,073 |
| 1983 | 194,631 | 39,584 | 18,811 | 8,926 | 77,840 | 53,067 | 47,049 | 439,908 |
| 1984 | 205,506 | 42,283 | 19,506 | 11,774 | 92,252 | 52,827 | 48,598 | 472,747 |
| 1985 | 217,435 | 41,097 | 20,274 | 11,980 | 99,143 | 52,588 | 49,317 | 491,834 |
| Without Major Projects | | | | | | | | |
| 1980 | 173,017 | 35,221 | 17,766 | 8,348 | 66,283 | 53,794 | 46,054 | 400,481 |
| 1981 | 179,585 | 35,760 | 18,069 | 8,536 | 68,373 | 53,551 | 46,191 | 410,065 |
| 1982 | 186,402 | 36,307 | 18,377 | 8,729 | 70,536 | 53,308 | 46,328 | 419,987 |
| 1983 | 193,478 | 36,863 | 18,690 | 8,926 | 72,773 | 53,067 | 46,465 | 430,262 |
| 1984 | 200,823 | 37,427 | 19,009 | 9,127 | 75,086 | 52,827 | 46,604 | 440,903 |
| 1985 | 208,446 | 38,000 | 19,333 | 9,333 | 77,480 | 52,588 | 46,742 | 451,922 |

[1]Based on growth projected in Statewide and Regional Economic and Demographic Systems, Beaufort Sea Impact Analysis, prepared for Alaska OCS Office by ISER, March 1981. Projected growth adjusted to equal 1980 Census, then assumed to grow to 1985 in a straightline pattern (without major projects).

[2]Major projects include NW Gasline, Alpetco, Pacific LNG, and a major petrochemical facility. These were added to straight-line growth based on direct employment, a secondary multiplier of 1.85, and a population-employment multiplier of 1.59.

[3]Includes Kenai and Kodiak Census Divisions.

[4]Includes Fairbanks and Southeast Fairbanks Census Divisions and Koyukuk and Yukon Flats Census Subareas.

[5]Includes Haines, Juneau, Ketchikan, Prince of Wales, Sitka, Skagway-Yakutat, and Wrangell-Petersburg Census Divisions.

These projections are based on assumed scenarios of the economic growth of the state. Two projections are provided to account for the uncertainty inherent in our assumptions of economic growth. One major cause of uncertainty is the level of activity on major construction and resource development projects. To account for this uncertainty, population projections are made which include these projects and which do not include these projects. The four major projects included are Northwest Gasline, Alpetco, Pacific LNG, and a major petrochemical facility.

The inclusion of the major projects has a significant effect on the population of the state; the state's population is almost 40,000 greater in 1985 as a result of these projects. Population grows at an annual average rate of 4.2 percent with the major projects and 2.4 percent without them. The regional distribution of the population is also important and is influenced by the development of these major projects. Under neither scenario is regional population growth proportional to the distribution of the 1980 population; the distribution of the population between regions changes over the forecast period with population concentrating in Anchorage and Fairbanks.

These projections of population can be combined with a set of assumptions about the state's response to the demand for land to estimate a range of demand. Tables 2 and 3 illustrate the possible range of demand under the existing eligibility requirements which allow residents to choose one homesite and one subdivision or lottery every eight years.

Table 2 provides the high projections of the private demand for state land. Under the existing eligibility requirements, a maximum possible demand for land results from an assumption that every eligible household demands one parcel of land. On average, we assume that the size of the parcel is five acres. Population change affects demand in two ways. Not only does population grow, but some residents leave and are replaced by new residents. This effect means new residents will enter the state even without population growth. Under these assumptions, the private demand for state land could be in excess of 200,000 acres per year over the next five years. This high level of demand reflects primarily the high level of existing demand from the 1980 population.

Table 3 shows the possible demand for land under a second set of assumptions concerning the purpose of the program. If we assume the purpose of the program is simply to provide land for use, a measure of demand may simply be the replacement of land used for housing. Table 3 shows the change in the number of households over the five-year forecast period. If the purpose of the program is merely to replace land taken from the market beginning in 1981, the average yearly land demand in the high case (assuming five-acre averages) would only be 29,854 acres. If we also assume the program will replace land used since 1970, the high case demand would rise to 68,770 acres. Under this assumption, the importance of location of the land is apparent. Little state land is available in Anchorage, which is a major population and growth center; if we assume that the state cannot replace land use in Anchorage, the demand in the high

TABLE 2. DEMAND FOR LAND, HIGH LEVEL
1980 - 1985

| | Population | New Migrants[1] | Eligible Households[2] | Land Demand[3] |
|---|---|---|---|---|
| With Major Projects | | | | |
| 1980 | 400,481 | | 125,567 | 627,835 |
| 1981 | 410,148 | 45,710 | 14,938 | 74,690 |
| 1982 | 422,073 | 48,838 | 15,960 | 79,800 |
| 1983 | 439,908 | 55,822 | 18,242 | 91,210 |
| 1984 | 472,747 | 72,431 | 23,670 | 118,350 |
| 1985 | 491,834 | 61,634 | 20,142 | 100,710 |
| Yearly Average (1981-85) | | | 43;704 | 218,520 |
| Without Major Projects | | | | |
| 1980 | 400,481 | | 125,567 | 627,835 |
| 1981 | 410,065 | 45,627 | 14,911 | 74,555 |
| 1982 | 419,987 | 46,828 | 15,303 | 76,515 |
| 1983 | 430,262 | 48,074 | 15,710 | 78,550 |
| 1984 | 440,903 | 49,365 | 16,132 | 80,660 |
| 1985 | 451,922 | 50,700 | 16,569 | 82,845 |
| Yearly Average (1981-85) | | | 40,838 | 204,190 |

[1]Assumes a turnover in population of 9 percent each year. This assumption is based on national data as reported in Huskey (1981) and 1970 Census data for Alaska as reported in Goldsmith (1978).

[2]Nets out previous winners. Assumes each household enters state land market only once. Assumes a 1980 average household size of 3.06.

[3]Assumes an average individual demand of five acres.

TABLE 3. DEMAND FOR LAND, LOW LEVEL
1980 - 1985

| | Change in Households Including Anchorage | Change in Households Without Anchorage |
|---|---|---|
| **With Major Projects** | | |
| 1980 | 44,176[1] | 23,203 |
| 1981 | 3,159 | 1,008 |
| 1982 | 3,897 | 2,245 |
| 1983 | 5,828 | 3,161 |
| 1984 | 10,732 | 7,178 |
| 1985 | 6,238 | 2,340 |
| Yearly Average[2] | 13,744 | 8,210 |
| Acres 1970-1985[3] | 68,720 | 41,050 |
| 1980-1985[4] | 29,854 | 15,932 |
| **Without Major Projects** | | |
| 1980 | 44,176* | 23,203 |
| 1981 | 3,132 | 986 |
| 1982 | 3,242 | 1,014 |
| 1983 | 3,358 | 1,046 |
| 1984 | 3,477 | 1,077 |
| 1985 | 3,601 | 1,110 |
| Yearly Average[2] | 11,135 | 4,625 |
| Acres 1970-1985[3] | 55,675 | 23,125 |
| 1980-1985[4] | 16,810 | 5,233 |

[1]Change in households, 1970-1980.

[2]Adjusts for 5,309 winners, 3,007 non-Anchorage, and other.

[3]Assumes five acres average size and 1970-80 household growth is replaced.

[4]Assumes five acres average size and 1970-80 household growth is not replaced.

case is 41,050 acres. In the low population growth case, if Anchorage is excluded, the private demand for state land would be only 23,125 acres per year.

Under the assumptions described above, the yearly private demand for state land could range from 23,000 acres to 220,000 acres. While each of these could be reasonable results, given the assumptions about program goals and participation, the range is too broad to be of much use in the planning or management of the disposal program.

There are reasons to believe that neither extreme assumption is an accurate reflection of participation in the state lottery program. First, as with any good, not everyone will want to own a parcel of land, even if the land were free. In Alaska, transient workers, with no plan to stay in the state, may have no desire to own land. Since land is not free under the state's program, demand will be reduced even for those who desire to own land. This will mean demand (given program participation constraints) will probably be less than the high estimate based on every household buying a parcel. A second restriction on the low assumptions is that people demand land for more than homesites. Land is used for recreational purposes. People may wish to hold land for investment or speculative purposes. This will mean demand for state land will be greater than the low estimate based on the replacement of homesite land.

Some method is needed to narrow the projected range of demand for state land. Fortunately, the land sales data from past land disposals

offers the ability to say more about private demand for state land. This information not only allows us the ability to estimate the level of demand but also provides a means of examining the effects of changes in some of the determinants of demand. This section examines what information the state sales data provides about the determinants of the demand for land.

The major problem with using the sales data is the difficulty of interpreting what is being measured. Because of this, it is necessary to make some assumptions prior to using the data. Two assumptions are necessary. The first necessary assumption is that the demand in any one sale represents the total demand for the land offered at that time. This is an extreme assumption since it does not allow for changes in tastes and income which may affect demand. The second necessary assumption is that the demand represented is the normal demand; this assumes there was no increase in demand simply because of the initiation or newness of the program.

Under these assumptions, one sale provides a description of the demand facing state land. We can see that not everyone wants land. Based on an analysis of the applications in the land disposal program,[1] we find that only 4.4 percent of the population demanded subdivision sites; .9 percent, homesites; and .8 percent, remote

[1]The Spring 1980 lottery was used for homesites and subdivisions because it was large and assumed to be representative of the state's possible future sales. The Fall 1979 lottery was used for the remote lottery.

parcels.[2] These per capita demands provide estimates of yearly demand shown in Table 4. These assumptions result in an average yearly demand between 1981 and 1985 which ranges between 62,626 and 68,425 acres.

Our discussion of the determinants of demand would lead us to assume that the use of the overall per capita demand, while it shows that not everyone is interested in purchasing state land, ignores many of the important determinants. To project demand, we must consider these determinants. Tables 5-7 illustrate the effect of some important determinants on the demand for lottery parcels.

Statewide per capita demand is an average of the per capita demand in each area of the state. Using statewide averages for projection implicitly assumes either that growth will be distributed across the state in proportion to the current population or that the per capita demand is similar in all areas of the state. Table 1 shows that according to our assumed growth, regional population growth is not proportional to existing population. Table 5 shows that demand also varies across regions.

This regional difference will affect overall demand. Anchorage is projected to be one of the fastest growing regions in the state, and its per capita demand for subdivisions and homesites is below the state average. Over time the growth of Anchorage will reduce the state's per capita demand.

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[2]Using the 1980 Census population as a base.

TABLE 4. DEMAND FOR LAND

(Assuming Per Capita Levels Found in State Disposal Program)[1]

| | Subdivision | Homesites | Remote | Acres[4] |
|---|---|---|---|---|
| Per Capita Demand | .044 | .009 | .008 | |
| With Major Projects[2] | Applicants | | | |
| 1980[3] | 14,734 | 2,918 | 792 | 155,305 |
| 1981 | 2,011 | 411 | 365 | 29,918 |
| 1982 | 2,149 | 441 | 392 | 32,108 |
| 1983 | 2,456 | 501 | 448 | 36,684 |
| 1984 | 3,187 | 651 | 581 | 47,594 |
| 1985 | 2,712 | 555 | 493 | 40,456 |
| Yearly Average | | | | 68,425 |
| Without Major Projects | | | | |
| 1980 | 14,734 | 2,918 | 792 | 155,305 |
| 1981 | 2,008 | 411 | 365 | 29,954 |
| 1982 | 2,060 | 420 | 373 | 30,674 |
| 1983 | 2,115 | 432 | 384 | 31,531 |
| 1984 | 2,172 | 444 | 395 | 32,404 |
| 1985 | 2,231 | 456 | 465 | 33,260 |
| Yearly Average | | | | 62,626 |

[1]Based on results of Spring 1980 lottery, except for remotes which are based on Fall 1979 sale.

[2]Based on 1980 population and change after 1980. Change includes both replacement and new migrants.

[3]Adjusts for 685 winners of homesites and 2,888 winners of subdivisions and 2,413 winners of remote parcels.

[4]Based on distribution of land demand by type and average acres for each type. This provides the following average acres for each type: Subdivision, 8 acres; homesite, 3.6 acres; remote, 34 acres.

TABLE 5. PER CAPITA DEMAND BY RESIDENCE

| Regions | Per Capita Applications | | |
|---|---|---|---|
| | Subdivision | Homesites | Remote |
| Anchorage | .031 | .005 | .011 |
| Fairbanks | .068 | .025 | .009 |
| Juneau | .081 | .003 | .001 |
| Kenai-Kodiak | .011 | .003 | .011 |
| Other Southeastern | .103 | .014 | .001 |
| Matanuska-Susitna | .021 | .007 | .015 |
| Valdez | .139 | .073 | .005 |
| Rest of State[1] | .130 | .037 | .005 |

[1]Excludes areas outside railbelt, Southeastern, and Interior.

What explains regional differences in the quantity of state land demanded? There are major reasons for this difference. First, tastes and incomes differ in different areas. Tastes and incomes are major determinants of demand, so demand will differ in different areas. Urban and rural areas of the state will have different uses for state land.

The second reason for regional differences in the quantity of land demanded is differences in the supply of land facing each region. Supply has two dimensions, quality and price. We have addressed the quality dimension by defining different types of land. The supply of each type of land facing a region is defined by the cost of purchasing that land in the region. The cost of buying land is made up of the sales price and cost of using the land, such as travel costs, taxes, improvement costs. In areas with high relative market demand, the selling price will be higher because the state uses market price as the appraised value. More importantly, since land is offered in alternate locations, the travel cost of land differs in each region. Differences in travel cost represent differences in the supply of land in each area.

Tables 6 and 7 illustrate how differences in the supply of land affect the quantity demand. Table 6 shows how the demand for land under each program varies with distance from the residence. Since land is a normal good, we would expect the quantity demanded to decline as costs, represented by distance, increase. In each program, per capita demand falls as the distance to the parcels increases. The

TABLE 6. PER CAPITA DEMAND BY DISTANCE

| Distance from Home | Per Capita Applications | | | |
|---|---|---|---|---|
| | Subdivisions | | Remote | Homesites |
| | All Areas | Southeast | | |
| < 50 miles | .0175 | .0090 | .0028 | .0061 |
| 51 - 100 | .0072 | .0020 | .0027 | .0010 |
| 101 - 150 | .0042 | .0019 | .0002 | .0001 |
| 151 - 200 | .0030 | .0003 | - | .0004 |
| 201 - 250 | .0019 | .0001 | .0028 | .0005 |
| 251 - 300 | .0003 | - | - | - |
| 301 - 400 | .0003 | .0001 | .0003 | .0001 |
| 401 - 500 | .0002 | - | - | - |
| 501 - 700 | .0041 | .0036 | .0002 | .0002 |
| 701 + | .0047 | .0044 | - | .0006 |

only exception to this is that as distance increases over 500 miles, demand increases. This can be explained by what seems to be a perceived quality difference of land in Southeast Alaska. The second column shows that a large proportion of the demand for subdivision parcels over 500 miles is for demand in Southeast Alaska.

Table 7 illustrates the effect of the second dimension of supply, differences in the quality of the land. The table shows the excess demand for twelve types of subdivision land. Each land type is defined by three attributes of the land: size, water access, and road access. Excess demand is defined both by applicants net of winners and applicants net of parcels. These definitions will differ because applications are not uniformly distributed across all parcels within a land type.

This table shows that the demand for land is affected by the type of land. Applications are not uniformly distributed across all types of land. For the most popular land type (type 7), there were 62 times as many applicants as parcels offered. For some types, there were fewer applicants than parcels offered (type 2 and 12).

The results of this section are intended to show that the private demand for state land cannot be based on a simple set of assumptions about the use of the land. Demand for state land varies across regions of the state, so that growth of the population in different regions of the state will affect overall demand differently. The quantity of state land demanded will also depend on the supply

TABLE 7. THE DEMAND FOR LAND BY TYPE, SUBDIVISION LOTTERY[1]

| Type | Parcels Offered: Southeast | Parcels Offered: Rest of State | Winners | Applicants | Net Demand (Col.4 - Col.6) |
|---|---|---|---|---|---|
| 1) Large Lot less than 2 miles from road, water frontage | 1 | - | 1 | 238 | 237 (237)[2] |
| 2) Large Lot less than 2 miles from road, subdivision access to water | - | 8 | - | - | |
| 3) Large lot less than 2 miles from road, no water access | 12 | 183 | 168 | 1,962 | 1,794 (1,767) |
| 4) Large lot more than 2 miles from road, water frontage | 4 | - | 4 | 1,009 | 1,005 (1,005) |
| 5) Large lot more than 2 miles from road, subdivision access to water | 1 | - | 1 | 84 | 83 (83) |
| 6) Large lot more than 2 miles from road, no water access | - | 139 | 44 | 383 | 339 (244) |
| 7) Small lot less than 2 miles from road, water frontage | 64 | 21 | 80 | 4,032 | 3,952 (3,947) |
| 8) Small lot less than 2 miles from road, subdivision access to water | 166 | 208 | 307 | 2,286 | 1,979 (1,912) |
| 9) Small lot less than 2 miles from road, no water access | 43 | 1,803 | 936 | 3,479 | 2,543 (1,633) |
| 10) Small lot more than 2 miles from road, water frontage | 32 | 82 | 114 | 3,328 | 3,214 (3,214) |
| 11) Small lot more than 2 miles from road subdivision access to water | - | 163 | 38 | 198 | 160 (30) |
| 12) Small lot more than 2 miles from road, no water access | - | 1,390 | 129 | 369 | 240 (-1,021) |

[1]Based on Spring 1980 sale.

[2]Numbers in parentheses are total applicants minus parcels offered.

available. Differences in supply along two dimensions--quality and cost of ownership--were shown to affect the quantity demanded. In the next section, a model of the private demand for state land which takes account of these factors is developed and estimated.

## A Model of Private Demand for State Land

The previous discussion has shown that the quantity of state land demanded is a function of the supply available. The available supply is determined by the price of land, including travel costs and other costs of using the land, and the type of land available. Because of the effect supply offered has on quantity demanded, we cannot simply forecast the per capita demand from past sales independent of the available supply. If we expect supply to change, the forecast method must be able to account for the effect of this change on the quantity demanded. Since "good quality" land available for state disposal is limited, we would expect the supply to change over time. What is needed is a method of adjusting the projected demand to account for differences in supply. This section describes the preliminary development of a method for assessing the effect of changes in the available supply of land on the private demand for state land.

The model is developed as a set of demand equations which account for the effect of cost and characteristic differences. This model uses data from three previous disposals to estimate regressions which represent these demand equations. The intention for the use of the model is to continue to update these regressions as additional data from future sales becomes available. Although the model is used to

make a projection of demand, this cannot be seen as a final result; the next section details a plan for implementing and improving this method of assessing the demand for land.

The use of these regression results to forecast demand depends on two important assumptions about the role of the state disposal program in the state's land markets. First, we assume that the first sales, upon which these regressions are based, do not represent a "land rush" mentality. Although the initiation of the disposal program represents a structural change in the state land markets, we must assume that this has not affected demand in any aberrant fashion. This is, at best, a tenuous assumption. The state disposal program offers a major structural change to land market; this change includes both the magnitude of land offered and the marketing of this land. Major structural changes take some time to work through to an equilibrium relation. Because of this, these first sales may reflect the disequilibrium of the situation. As more sales occur, this possible disequilibrium aspect of the data will be reduced.

The second major assumption needed to use this approach is that the land disposal program represents a segmented land market which can be treated separately from the private land market in the state.[3] The assumption that state land disposal represents a segmented market is necessary if we are to forecast demand based only on the state disposal

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[3]Segmented markets are not completely independent. The price of private land will affect the demand for state land.

information. If the state disposal program did not present a separable part of the land market, we would be examining only part of the market. This assumption can be easily supported: the state disposal program is a separable segment of the land market in the state. The segmentation results from two characteristics, marketing techniques and product characteristics. Marketing techniques unique to the disposal program include the lottery system and ease of purchase. The private land market has nothing comparable to this for offering parcels. Price and financing also differ between the disposal program and the private market. Buyers in the lottery can apply a discount based on residency which lowers price below market price. Financing costs are also lower than in the private market. The final marketing characteristic which differs is the constraint on purchases. Only one-year residents are eligible to participate in the program. Participants are limited to one purchase of either a subdivision or remote site and one homesite purchase.

Even though the marketing characteristics are the most important for segmenting the state disposal program from the private market, it might also be argued that the products, or type of land, offered by the state differ significantly from those offered by the private market. The state offers large remote parcels which are not available from the private market. In addition, the state's subdivision program offers small unimproved parcels which may be unique in Alaska markets. Production differences also define the state disposal program as a separable part of the overall state land market.

The general model estimated in this section can be defined as

$$A^{p}_{ij} = F\ (T_j,\ C_i,\ P_{ij},\ P_{sj},\ Y_j)$$

where $A^{p}_{ij}$ is the per capita applications for type i land from origin j in program p.

$T_j$ represents the tastes at origin j.

$Y_j$ is the income at origin j.

$C_i$ represents the characteristics of type i land.

$P_{ij}$ is the cost of purchasing type i land for a resident of origin j.

and $P_{sj}$ is the cost of substitutes for type i land for residents of origin j.

The model is based on the theory of land markets outlined above. It assumes that land types differ and these different types reflect differences in characteristics of the land. The demand for each land type will differ as a function of its usefulness in producing various products of the land and the taste of consumers. The costs associated with purchasing the land (purchase price, travel costs, etc.) substitutes available, and the consumers' incomes also influence the demand for each land type.

Empirical application of this theory reflects the availability of information. Unfortunately, lack of data makes it necessary to compromise on the specification of the estimated equations and their relation to the theory. The results presented below are subject to two important limitations of the data. First, we have only limited information on the effect of the availability of substitutes on demand. Although there is regional variability in the availability of private land, we have no direct information on these markets.

Variation across land types offered in the three disposal areas we examined is not great enough to provide an understanding of how consumers react to alternate patterns of substitutes. The second limitation is that the data does not tell us enough about the consumer's demand. We know the per capita applications for each type of land from each origin in the state. Ideally, we would also like to know how applications varied across socioeconomic groups and the distribution of uses planned for each type of parcel. The first type of information would allow us to account for the effect of tastes and income on demand. The second type of information would allow us to examine the effect of differences in productivity of the land characteristics on demand. Our results are subject to the limitations imposed by this lack of information.

Before presenting the results of the statistical work, we will describe the steps taken in developing the demand equations. This is important both for understanding the results presented and for incorporating the methodology as an ongoing planning and management tool. The two main components of this methodology are data manipulation and the regressions.

Data Manipulation. Data used in this study was of three types: parcel demand data, land type data, and origin data. The end purpose of the data manipulation was to create one file which described the demand for particular types of land originating from various origins in the state. This final file was used to estimate the demand equations.

Parcel demand data was provided by DNR. This data described the number of applicants for each parcel offered in each of the three sales analyzed. This data was provided for each of nineteen subareas of the state, which served as the demand origins for our study. For the most part, these subareas were defined as census divisions. Two exceptions to this occurred. First, the census divisions were subdivided when they contained sales in specific areas. Second, the western and northern areas of the state were not included in the regression data. There was relatively little participation from these areas, and there were no sales in these areas.

The applications data was adjusted to reflect multiple applications. Under the current structure, residents of the state can apply for as many parcels as they wish. Because of this, the total number of applications will overestimate demand. To account for these multiple applications, the application data was adjusted by DNR. The multiple applications were adjusted by only counting an applicant on the first parcel for which he applied. (This procedure was currently available in the ALARS system.) This adjustment assumed that applicants apply for the same type of land, and multiple applications simply increase the applicants' chances of winning that type of land. This assumption was supported by conversation with DNR staff and casual observation of the applicant lists.

The characteristics of the parcel were used to group the parcels into land types; each land type consists of parcels with the same set of characteristics. Parcel characteristic information was collected

because we hypothesized that the applicant's demand was affected by the parcel's characteristics. The main source of information on these characteristics was the pamphlets issued by DNR for each sale.

There is no a priori set of land characteristics which can be selected to group land into land types. The optimal selection of a set of characteristics must be based on both theoretical and empirical evaluation. The definition of land characteristics can only be considered preliminary; the methodology would benefit from further investigation into the set of characteristics which determine land type.

We chose three sets of characteristics to describe land types. These characteristics reflected what we hypothesized to be important factors in the use of the land for residential, recreational, and investment purposes. The first characteristic was parcel access. Access was defined as being direct road access, less than two miles from the road and more than two miles from a road. Road access was hypothesized to be especially important for residential use. The main characteristic which was assumed to define recreation potential was access to water. Water access was defined as water frontage, subdivision access to water, and no water access. For the most part, water access meant access to streams or small lakes. The exception to this was in Southeast when water access meant ocean access and at Lake Minchumena which is a large lake. Each of these exceptions was accounted for. The final set of characteristics was access to communities. It was hypothesized that closeness to a community would

be important for residential and investment uses. Close to a community was defined as being within thirty miles of a community with a population of at least 1,000. The final set of land characteristics was location within the state. Location was assumed to be a proxy for other unexamined attributes such as scenery. Four broad regions of the state were defined (see Appendix B). Examination of the data led to the hypothesis that for subdivisions, parcels in Southeast Alaska were really distinct types; for remotes and homesites, the location in other areas of the state also seemed to be important.

These characteristics cannot be assumed to exhaust the set of possible important land type attributes. Other characteristics such as hunting and fishing potential and environmental constraints were examined. Both the limited expertise of the researchers and limited variability of the characteristics reduced our ability to include other attributes. Given the limitations of our approach, land types were defined as parcels with similar characteristics.

Grouping of parcels into land types was an evolutionary process. This process was constrained by the limited understanding of the researchers about which characteristics were important, limited information on parcel characteristics, and the time-consuming process of adjusting data to reflect changes in land types. Parcels were grouped into land types for this analysis in two steps. First, similar parcels within each subdivision were grouped. Parcels within each subdivision differed primarily by size and price. The second step was to group parcels into larger groups across subdivisions. To

do this, we established four regions of the state: Northcentral, Southcentral, Interior, and Southeast (see Appendix B for a description of subdivisions by region). Parcels within each region which were similar across land attributes, price, and size were grouped. This resulted in a very large number of groups. These groups were aggregated further by collapsing the price and acreage dimensions. To do this, we assigned the average price and size to each land type within each region and two general size categories (small if less than ten acres and large if greater than ten acres). This process allowed us to place each parcel of land offered in the disposal program into one of the thirty-six land types which describe the possible combinations of land attributes shown in Table 8.

Parcels were grouped into land types so that demand could be examined for these types. The demand from each origin was described for these thirty-six parcel types. Applicants for each parcel were summed into total applicants for each type offered in each region. Applicants were summed across parcels to provide a description of demand by parcel type. Examining the demand by land type assumes that consumers demand types of land and the distribution among parcels of a particular type is a random distribution.

Origin data was added to the parcel data. The origin data included population, which was the 1980 Census population for the census division or subcensus-division region; this population was used to create per capita applicants. Additionally, the distance between each origin and each land type for which demand was positive was

TABLE 8. LAND TYPE ATTRIBUTES

1. Road Access

   a. Direct road access (to parcel)
   b. Less than two miles from road
   c. More than two miles from road

2. Water Access

   a. Direct water frontage
   b. Subdivision access to water
   c. No water access

3. Community Access

   a. Close to community (within 30 miles of community with greater than 1,000 population)
   b. Not close

4. Size

   a. Large (greater than 10 acres)
   b. Small (less than 10 acres)

included in the origin observation. Distance serves as a proxy for travel costs. Ideally, travel cost would be incorporated directly into the equation as part of an expanded price term. To do this, information on the travel requirements was needed. Each of the three major types of uses for the land has different travel requirements. Because we could not distinguish the use of the land, we could not assign a travel cost. Straightline distance between origin and most popular parcel of a given land type was used.

The parcel demand, parcel characteristic, and origin data were combined to provide the data used in the regression equations. Each observation includes all information. The observations included per capita applications from a particular origin for a particular land type; the distance between origin and parcel type; and the price, size, and other characteristics of the parcel type. Each of three state sales provided a separate set of observations.

Regressions. Regressions were run over this data for each type of sale: subdivision, remote, and homesites. In addition, subdivision regressions were run for large and small parcels. The demand equations were regressed in log-log form. The dependent variable (per capita applicants) and price variables were in logarithms; characteristic data which were primarily dummy variables were not.[4] The demand equations are primarily cross-section regressions, even though

[4]Dummy variables are used to describe an all-or-nothing situation. The dummy variable equals one if the parcel possesses a characteristic and zero if it does not.

observations from all three sales are included. The main variation in demand is observed across origins and land types. The regression results are shown in Table 9. The regressions explain approximately one-half of the variation in per capita demand in each program ($R^2 > .50$).

We examine the results of the subdivision regressions since, of the three programs, the regression equations are most successful in explaining demand for subdivision parcels. These regression equations will be examined as a test of the hypothesis proposed in the first section of this paper. There are three sets of variables which will be examined: price variables, parcel attributes, and origin/substitute variables. Price variables include distance, which is a proxy for travel cost, and purchase price. Distance is significant and of the hypothesized sign in all equations; demand falls as the distance to the parcel increases. Price is also significant in both of the subdivision equations; however, the sign differs in each. For large parcels, the sign is negative as hypothesized; increases in price result in a reduction in the demand for the parcel. For small parcels, the coefficient on price is positive, which is opposed to the traditional assumed effect of price. There are two possible explanations for this. The most important is that price may capture some important quality differences which cannot be defined by the characteristics included. This is an important problem in studies of this nature since it may be impossible to isolate all characteristics which define quality. A second reason has to do with the discount. Because of the ability discount of the price of land, a high market price may

TABLE 9. REGRESSION RESULTS

| | Subdivision | | | |
|---|---|---|---|---|
| | Large | Small | Homesite | Remote |
| **Price Variables** | | | | |
| Distance[1] | - .647[2] | - .813[2] | - .570[2] | - .811[2] |
| Price[1] | -1.292[2] | .509[2] | -- | -- |
| **Price Attributes** | | | | |
| Acres | .0187[3] | - .075 | - .008 | .045[2] |
| Direct Water Access | | - .007 | 1.104 | .255 |
| Direct Water Access in Southeast | 2.937[2] | 1.195[2] | - .394 | -- |
| Subdivision Water Access | -1.792[2] | - .409[3] | -1.314 | -- |
| Subdivision Water Access in Southeast | .814 | 1.088[2] | 1.924[3] | -- |
| Close to Community | - .295 | .006 | - .202 | - .281 |
| Close to Community in Southeast | -1.060[2] | - .358 | - .704 | -- |
| Direct Road Access | -- | -- | .251 | - .682 |
| Less than 2 Miles from Road | -1.252[2] | .839[2] | .144 | .104 |
| Less than 2 Miles from Road in Southeast | 1.511[2] | .154 | - .098 | -- |
| Region: Interior | -- | -- | - .279 | - .922[2] |
| Southcentral | -- | -- | .063 | .900[2] |
| Lake Minchumina | -- | 1.519[2] | -- | -- |
| **Origin and Substitutes** | | | | |
| Anchorage | -1.591[2] | - .988[2] | -2.273[2] | -1.090[2] |
| Fairbanks | -1.501[2] | -1.026[2] | -1.724[2] | -1.046[2] |
| Juneau | - .311 | - .723[2] | -1.912[2] | - .692 |
| Kenai-Kodiak | -1.377[2] | -1.213[2] | -1.286[2] | - .790[2] |
| Matanuska-Susitna | -1.652[2] | -1.657[2] | -1.329[2] | - .107 |
| Other Southeast | .077 | - .602[2] | - .326 | - .246 |
| Constant | 10.171 | -7.010 | -3.929 | -4.591 |
| $R^2$ | .563 | .623 | .593 | .496 |
| Standard Error | 1.138 | 1.087 | 1.112 | .987 |

[1]Logarithm in the regression.

[2]Significant at the 95 percent level.

[3]Significant at the 90 percent level.

be a superior characteristic. Discounts are in percentages, so a higher price means a larger savings; and if the price reflects actual market conditions, this means a greater prospective return if the land were resold.

The effect of the characteristics in the regressions are mixed. The importance of access to water can be seen. Access to ocean in Southeast and large lakes at Lake Minchumina has a strong positive significant effect on demand.

The effect of road access was more mixed. Easy road access (less than two miles) had a positive effect for small subdivision lots and for large lots in Southeast, but generally had a negative effect on large lots.

Our investigation of the effect of road access on subdivision demand provides an example of the importance of correctly defining attributes. In prior regressions, direct road access was included as an explanatory variable. The sign on this variable was consistently found to be negative, which refuted a hypothesized positive effect on demand. Further examination showed this effect was the result of a faulty definition of parcel attributes. Direct road access was a parcel-specific attribute. Examining the data further showed people did not want a subdivision parcel right on the road but had a strong preference for parcels in subdivisions which had direct access to some parcels. For this paper, direct road access was dropped as an explanatory variable.

The size of the parcel only had a significant effect for large lots; the effect on demand was positive. The insignificant effect in the other case is the result of little variation in the size of these offerings.

The final category of variables includes a set of dummy variables representing the origin of the applicant. These variables serve two functions. First, they reflect differences in both tastes and incomes across regions of the state. Secondly, they reflect available substitutes. It is difficult to suggest what the appropriate substitutes are for state land disposals. Offerings in a disposal will affect the demand for other offerings, but available private land will also affect demand for state parcels. Both the available state offerings and the availability of private land will differ in different areas of the state. Describing substitutes as available state disposal lands was tried with little success. The limited variability shown by three sales was probably the reason. The origin dummies were used to describe substitutes. The coefficients on these variables are significant, although their interpretation is not straightforward.

The regression equations examined in this section were estimated for two reasons. First, the regressions were estimated to show the effect of supply, in both of its dimensions, on the quantity of state land demanded. Secondly, the regression results provide the basis for forecasting future private demand for state land. The set of regressions described in Table 9 shows that supply does matter. Distance between residence and parcel has an important effect on demand in all

programs. For the subdivision lottery programs, the other supply dimension--quality--was shown to have a significant effect on the quantity demanded. The characteristics of the parcels had less importance in explaining demand for remote parcels and homesites. The explanation for this may differ for each program. The characteristics defined may be inappropriate for remotes; for example, direct road access or disposal area access to water may make little difference considering the large land area which is involved. For homesites, the explanation may be that only access defined by distance to where you live now is important since homesites must be occupied. The next section describes the usefulness of these regression equations for forecasting demand.

Forecast

This section provides a set of forecasts of the private demand for state land. The set of forecasts reflects varying assumptions about the future levels of major determinants. The accuracy of any of the forecasts depends on the accuracy of the assumptions on which they depend. The uncertainty inherent in these assumptions makes the projections probabilistic.

There are two major sets of assumptions, those which describe the growth of population and those that describe the proportion of the population which will participate in the program. Population growth is the major determinant of the aggregate growth in the demand for land. The level of participation is influenced by consumers use of the land and the existing supply. The effects that changes in this set of assumptions has on the projected demand are examined.

The quantity of land demanded is forecast as a function of population growth and the per capita demand for land. The projection is done by regions since both population growth and the demand for land vary across regions. Per capita demand describes the share of the population in each region which would apply for land. A separate per capita demand assumption is made for each type of land in each program (see Appendix B for a definition of the land types used in this projection).

The total quantity of land demanded in any year is found by summing demand by region and type over all regions and land types. Ideally, we would like to distinguish between different population groups which reflect differences in demand. Information was not available to make this distinction for this study. The total demand for land is found as

$$D_T = \sum_i \sum_j POP_i * d_{ij}$$

where $D_T$ is total demand for land

$POP_i$ is the population in region i

$d_{ij}$ is the per capita demand for the jth type of land in the ith region.

Population projections used in this study are shown in Table 1. They are based upon an assumed level of economic activity in each region of the state. The demand for land is influenced, not only by the net increase in population but also by the turnover in the population. New residents enter the state as replacements of residents who have left the state. These new residents also can apply for land, so the population from which applicants are drawn must reflect this turnover.

Table 10 shows the total potential applicants for the period between 1981 and 1985 in seven regions of the state under four alternate scenarios. Total potential applicants were found by adding the new population in each year of this period to the base 1980 population. New population in each year equals the net change in population plus replacement population. Total potential applicants are found with the following formula:

$$TPA_i^T = POP_i^{80} + \sum_{i=80}^{T} (POP_{T-1} * t + POP_T - POP_{T-1})$$

where $TPA_i^T$ is total potential applicants in region i in year T

$POP_i^T$ is total population in region i in year T

t is the turnover rate which describes the proportion of the population leaving the state in any year.

This formula assumes that all residents of the state between 1980 and 1985 are potential applicants.

Two assumptions are necessary to use total population as the determinant of aggregate demand. The first is that there is no major change in the age distribution of the population; the proportion of the population under 18 is assumed to remain constant. The second assumption reflects the use of average annual population. People move to the state throughout the year, and seasonal peaks in population reflect peaks in employment. To use average annual population as a measure of potential applicants, we must assume that the distribution of tenure or length of residency in the state also stays the same

TABLE 10. TOTAL POTENTIAL APPLICANTS[1]
1981-1985

| | High[2] | Moderate[3] | $Low_1$[4] | $Low_2$[5] |
|---|---|---|---|---|
| Anchorage | 301,965 | 297,204 | 292,442 | 255,110 |
| Fairbanks | 133,160 | 121,207 | 109,253 | 95,133 |
| Kenai-Kodiak | 58,162 | 56,252 | 54,342 | 47,078 |
| Mat-Su | 28,602 | 28,104 | 27,605 | 23,928 |
| Valdez | 16,148 | 14,706 | 13,263 | 11,516 |
| Southeast | 76,577 | 76,577 | 76,577 | 63,093 |
| Other | 70,411 | 69,001 | 67,590 | 58,325 |

[1]Total population in each region over the period; includes base 1980 population plus new and replacement population.

[2]Based on high projection in Table 1; assumes 9 percent turnover in population.

[3]Based on assumptions that one-half of population difference between high and low do not participate in land program.

[4]Based on low projection in Table 1; assumes 9 percent turnover in population.

[5]Based on low projection in Table 1; assumes 5 percent turnover in population.

throughout the projection period; the residency is also assumed to remain the same throughout the period.

The high potential applicants reflects the population in the high growth scenario and a nine percent turnover rate in the population. Nine percent reflects the historical turnover in Alaska. The $low_1$ applicants reflects the low growth scenario and the nine percent turnover. The moderate applicants assumes that not all people moving to Alaska in the high scenario are interested in living here; this reflects a "boomer" attitude. We assume that one-half of the population difference between the high and $low_1$ scenarios do not participate in the land disposal program. Finally, the $low_2$ applicants reflects the low scenario growth and an assumed stabilization of the Alaska population reflected in a reduction of the turnover rate to five percent.

Per capita demand parameters were based on an analysis of past state sales. Ideally, the demand equations discussed in the last section would be used to estimate the per capita demand in each region for each type of land. These equations could be used to estimate the effect of changes in supply, in both its quality and location dimensions, on per capita demand.

The model results were not used to estimate per capita demand in this exercise. Because of the limited available data and the problems of specification, we felt the equations were not good predictors of demand. Each equation explained no more than fifty percent of the

variation in per capita demand. The effects of these problems on the projection ability of the regression equations can be seen in Table 11 which compares the actual and predicted values of regional per capita demand for the Spring 1980 sale. The percentage error is especially high for major population centers such as Anchorage and Fairbanks.

These results do not mean that regression estimates of per capita demand should be ignored. Further analysis should be undertaken by DNR to attempt to solve the specification and data problems so that a set of demand equations can replace the assumptions used in this work. Demand equations would be especially helpful for examining the effect of changes in supply. We show below how the demand equations can be used to adjust the forecast for assumed changes in supply conditions.

The forecasts presented in this study reflect a set of assumed levels of per capita demand. Per capita demand parameters were found for each of eight types of land (land in Southeast Alaska was also distinguished) for three programs in each region. These parameters were used to make the base case, no change in supply conditions, forecast. The per capita demand parameters are shown in Table 12.

In selecting a representative set of per capita demand parameters, per capita demand in each sale by region, program, and land type was examined. Differences in per capita demand in these sales were largely a result of the type of land offered. We assumed that the Spring 1980 sale represented the total private demand for state land; it was felt that the distribution across types in this sale may

TABLE 11. COMPARISON OF PREDICTIONS USING DEMAND EQUATIONS SPRING 1980

| Region | Actual | Predicted | Percentage Difference |
|---|---|---|---|
| | Subdivisions | | |
| Anchorage | .031 | .020 | 65 |
| Fairbanks | .076 | .033 | 57 |
| Kenai-Kodiak | .011 | .009 | 12 |
| Matanuska-Susitna | .021 | .013 | 38 |
| Valdez | .132 | .057 | 57 |
| Southeast | .100 | .074 | 26 |
| | Remote | | |
| Anchorage | .004 | .003 | 25 |
| Fairbanks | .001 | .002 | 100 |
| Kenai-Kodiak | .001 | .001 | - |
| Matanuska-Susitna | .013 | .017 | 31 |
| Valdez | - | - | - |
| Southeast | .001 | .001 | - |
| | Homesites | | |
| Anchorage | .005 | .003 | 40 |
| Fairbanks | .027 | .006 | 78 |
| Kenai-Kodiak | .003 | .003 | - |
| Matanuska-Susitna | .007 | .007 | - |
| Valdez | .045 | .012 | 73 |
| Southeast | .010 | .007 | 30 |

TABLE 12. PER CAPITA DEMAND BY LAND TYPE BY REGION

(Applicants per 1,000 Population)

| Land Type | Anchorage | Fairbanks | Kenai | Mat-Su | Valdez | Southeast |
|---|---|---|---|---|---|---|
| Subdivision | | | | | | |
| 3 | 1.07 | 16.61 | 1.04 | 1.79 | 10.95 | 2.25 |
| 4 | 1.49 | .97 | .21 | 1.87 | .83 | .25 |
| 5 | 5.34 | 2.43 | .85 | 3.89 | 85.77 | .37 |
| 6 | 5.67 | 14.41 | 2.22 | 6.79 | 4.64 | 1.39 |
| 7 | 5.79 | 22.65 | 1.95 | 3.36 | 18.58 | .84 |
| 8 | 1.76 | .45 | .12 | 2.31 | 1.49 | .51 |
| in Southeast | | | | | | |
| 1 | .33 | .40 | .15 | .15 | - | 2.67 |
| 2 | 1.72 | 1.58 | .36 | .97 | .99 | 11.90 |
| 3 | .36 | .64 | .21 | - | - | 5.74 |
| 5 | 6.32 | 9.09 | 3.62 | 6.05 | 6.14 | 48.86 |
| 6 | 1.17 | 2.06 | .46 | .45 | .50 | 18.05 |
| 7 | 1.20 | .84 | .51 | .08 | 3.65 | 8.13 |
| Remote | | | | | | |
| 1 | .44 | 1.12 | .48 | 1.19 | .33 | .11 |
| 2 | 5.84 | 4.36 | 2.03 | 13.38 | 4.97 | .53 |
| 4 | .80 | 3.19 | .28 | 5.31 | 1.66 | .75 |
| Homesites | | | | | | |
| 5 | .53 | .52 | .25 | .84 | 9.56 | .02 |
| 6 | .05 | - | - | .10 | - | - |
| 7 | 3.30 | 24.85 | 1.65 | 4.79 | 36.54 | .53 |
| 8 | .40 | .46 | .27 | 1.21 | - | .04 |
| in Southeast | | | | | | |
| 5 | .65 | 1.03 | .69 | .64 | - | 6.71 |
| 6 | .18 | .37 | .17 | .22 | - | 2.67 |
| 7 | .04 | .05 | .06 | - | - | .47 |

have been affected by the limited types of remote parcels offered. To account for this, per capita demand by type was not taken directly from this sale. The following adjustments were made:

1. The demand for remotes and subdivision was assumed to equal the sum of the total demand for each in this sale plus the winners in previous lotteries.
2. Total applications in each region were allocated among type of land and programs using a distribution based on subdivision sales in the Spring 1980 sale and remote parcel sales in the Fall 1979.[5]
3. Homesite demand by region and land type was assumed to be the same as found in the Spring 1980 sale.

The per capita demand parameters found in this study represent the quantity demanded subject to the supply conditions represented by these two sales. Substantial changes in supply will result in changes in the quantity demanded.

Tables 13 and 14 illustrate the set of forecasts which result from this combination of population growth, turnover, and per capita demand assumptions. Table 13 illustrates the distribution of total applications for the entire period across programs and regions. Total applicants differ across scenarios because of different assumed levels

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[5]Remote parcels in Kenai and Anchorage were adjusted to reflect an assumption that land in Homer will not be available in future sales. Per capita demand in the second sale was substituted to reflect this assumption.

TABLE 13. TOTAL FIVE-YEAR LAND DISPOSAL PROGRAM APPLICANTS BY TYPE

(no change in supply)

| | Anchorage | Fairbanks | Kenai-Kodiak | Matanuska-Susitna | Valdez | Southeast | Other[1] |
|---|---|---|---|---|---|---|---|
| High | | | | | | | |
| Subdivision | | | | | | | |
| Large | 1,503 | 2,691 | 114 | 136 | 210 | 1,744 | 62 |
| Small | 8,228 | 6,908 | 566 | 656 | 1,949 | 5,983 | 304 |
| Remote | 2,134 | 1,151 | 162 | 568 | 111 | 104 | 14 |
| Homesite | 1,557 | 3,627 | 177 | 238 | 652 | 803 | 28 |
| Moderate | | | | | | | |
| Subdivision | | | | | | | |
| Large | 1,480 | 2,450 | 111 | 134 | 192 | 1,744 | 61 |
| Small | 8,098 | 6,288 | 548 | 645 | 1,775 | 5,983 | 298 |
| Remote | 2,101 | 1,048 | 157 | 558 | 101 | 104 | 14 |
| Homesite | 1,532 | 3,301 | 172 | 234 | 593 | 803 | 28 |
| $Low_1$ | | | | | | | |
| Subdivision | | | | | | | |
| Large | 1,456 | 2,208 | 107 | 131 | 173 | 1,744 | 59 |
| Small | 7,968 | 5,668 | 529 | 633 | 1,601 | 5,983 | 292 |
| Remote | 2,067 | 945 | 152 | 548 | 91 | 104 | 14 |
| Homesite | 1,508 | 2,976 | 166 | 230 | 535 | 803 | 28 |
| $Low_2$ | | | | | | | |
| Subdivision | | | | | | | |
| Large | 1,270 | 1,923 | 93 | 114 | 150 | 1,437 | 51 |
| Small | 6,951 | 4,935 | 458 | 549 | 1,390 | 4,929 | 252 |
| Remote | 1,803 | 823 | 132 | 475 | 79 | 86 | 12 |
| Homesite | 1,315 | 2,591 | 144 | 199 | 465 | 662 | 24 |

[1]Based on average of 5.2 applicants per 1,000 population for subdivision, .4 applicants for homesites, and .2 for remote parcels found in the Spring 1980 sale.

TABLE 14. DEMAND FOR LAND (1981-1985)
YEARLY AVERAGE

| | Applicants[1] | Winners[2] | Net | Yearly Average | Acres[3] |
|---|---|---|---|---|---|
| High | | | | | |
| Subdivision | | | | | |
| Large | 6,460 | 635 | 5,825 | 1,165 | 29,125 |
| Small | 24,594 | 2,253 | 22,341 | 4,468 | 17,872 |
| Remote | 4,244 | 2,413 | 1,831 | 366 | 12,444 |
| Homesite | 7,082 | 685 | 6,397 | 1,279 | 4,604 |
| | | | | | 64,045 |
| Moderate | | | | | |
| Subdivision | | | | | |
| Large | 6,172 | 635 | 5,537 | 1,107 | 27,675 |
| Small | 23,635 | 2,253 | 21,382 | 4,276 | 17,104 |
| Remote | 4,083 | 2,413 | 1,670 | 334 | 11,356 |
| Homesite | 6,663 | 685 | 5,978 | 1,196 | 4,306 |
| | | | | | 60,441 |
| Low$_2$ | | | | | |
| Subdivision | | | | | |
| Large | 5,038 | 635 | 4,403 | 881 | 22,025 |
| Small | 19,464 | 2,253 | 17,211 | 3,442 | 13,768 |
| Remote | 3,410 | 2,413 | 997 | 199 | 6,766 |
| Homesite | 5,400 | 685 | 4,715 | 943 | 3,395 |
| | | | | | 45,954 |

[1]Total applicants 1981-1985.

[2]Winners in lotteries through Fall 1980.

[3]Assumes average of 25 acres for large subdivision, 4 acres for small, 34 acres for remote sites, and 3.6 acres for homesites.

of population growth. In general, small subdivision parcels have the greatest number of applicants. The greatest demand comes from the major population centers of Fairbanks and Anchorage. This reflects not only the large growth of population in these areas, but also the relative accessibility of these areas to land offered in past sales.

Table 14 shows the average yearly applicants for the period. One of the major factors determining the number of applicants is the demand generated by the 1980 base population; this explains the limited variation in demand across growth scenarios. Implicit in these projections is the assumption that all of this demand should be met within the five-year period. If demand were to be met over a ten-year period, the yearly average would fall. The distribution of applicants across programs affects the amount of land demanded. Using weighted averages of parcel size by parcel type from past sales where the weights were proportion of applicants, we estimated average parcel size by program. Using these parameters, a yearly average demand of between 46,000 and 64,000 acres of land per year was forecast.

This narrows our previously projected range of demand. The projections must be taken with some caution for a number of reasons. First, the per capita demand parameters may reflect "land rush" mentality of new programs. Future sales may show a reduction in these parameters as residents adjust to the new program. Secondly, the projections may overestimate the potential pool of applicants. The turnover assumed in the population may be overestimated. In addition, both the distribution of length of residency and age may change.

Finally, changes in supply of state disposal land and private land will affect the quantity of state land demand. The next section uses the regression equations estimated above to estimate the effect of probable changes in supply.

Changes in the Supply of State Land

We have shown, both theoretically and with our regression equations, that the quantity demanded depends on the supply of land available. Changes in the supply dimensions of the land that the state has to offer will affect the quantity of land demanded. Supply varies in both quality, represented in our study by land type, and cost, of which one major determinant is distance. Demand estimates made above assume the future supply of state land will be similar to the supply offered in past sales. If we assume the state has only a limited supply of good, close land available, the supply will change over time.

Two changes in supply are probable. First, the distance to sites offered will probably increase as the closer parcels are taken. Secondly, some particular types of land may be eliminated from the supply. Each of these represents quality changes in the supply of land.

Another supply change which will affect the demand for state land is the supply of private land offered. With more state sales, the private supply of land will change in two ways. First, state disposal land will enter private holdings and may be offered for sale in the

private market. Secondly, private land owners may adjust their expectations of the future return from holding land. Reduced estimates of future returns may result in a reduction in the offer prices of private land and an increase in the supply of private land offered. This section will examine the effect of each of these supply changes on the demand forecast.

Table 15 illustrates the effect of a change in the cost dimension of the supply of land. One of the major factors affecting the cost of purchasing a parcel of land is the cost of traveling to the parcel to use it; this cost is a function of distance. In this table, we assume that the land offered by the state changes from the supply offered in previous sales as a result of changes in the distance between origins and land offered. The projections in Table 15 assume that the average distance between origins and land offerings increases by five percent each year after 1981 for the remainder of the projection period; on average, parcels are approximately 20 percent farther by 1985 in this scenario.

Even though the demand equations estimated in the last section cannot be used to project per capita demand, they can be used to estimate the effect of changes in supply. The approach used to adjust the per capita demand projections in Table 12 is explained below. The regression equations estimated above provide the following general demand equation (ignoring price and substitute variables):

TABLE 15. CHANGE IN DEMAND WITH CHANGE IN SUPPLY

COST DIMENSION[1]

| | 1981 | 1982 | 1983 | 1984 | 1985 | Average | Acres[2] |
|---|---|---|---|---|---|---|---|
| High | | | | | | | |
| Subdivision | | | | | | | |
| Large | 1,165 | 1,129 | 1,094 | 1,060 | 1,027 | 1,095 | 27,375 |
| Small | 4,468 | 4,294 | 4,126 | 3,965 | 3,811 | 4,133 | 16,532 |
| Remote | 366 | 352 | 338 | 325 | 312 | 339 | 11,526 |
| Homesite | 1,279 | 1,244 | 1,211 | 1,178 | 1,146 | 1,212 | 4,363 |
| | | | | | | | 59,796 |
| Moderate | | | | | | | |
| Subdivision | | | | | | | |
| Large | 1,107 | 1,073 | 1,039 | 1,007 | 976 | 1,040 | 26,000 |
| Small | 4,276 | 4,109 | 3,949 | 3,795 | 3,647 | 3,955 | 15,820 |
| Remote | 334 | 321 | 308 | 296 | 285 | 309 | 10,506 |
| Homesite | 1,196 | 1,164 | 1,132 | 1,102 | 1,072 | 1,133 | 4,079 |
| | | | | | | | 56,405 |
| Low[2] | | | | | | | |
| Subdivision | | | | | | | |
| Large | 881 | 854 | 827 | 802 | 777 | 828 | 20,700 |
| Small | 3,442 | 3,308 | 3,179 | 3,055 | 2,936 | 3,184 | 12,736 |
| Remote | 199 | 191 | 184 | 177 | 170 | 184 | 6,256 |
| Homesite | 943 | 918 | 893 | 869 | 845 | 894 | 3,218 |
| | | | | | | | 42,910 |

[1]Assumes average distance to sites increases by 5 percent each year after 1981.

[2]Assumes average of 25 acres for large subdivision, 4 acres for small, 34 acres for remote sites, and 3.6 acres for homesites. Based on weighted average of past sales.

$$A_{ij} = e^{(a+b*C)} \text{ (Distance)}^{d}$$

where $A_{ij}$ is the per capita applications from region i for type j land

C represents the parcel characteristics

a, b, d are coefficients

The effect of a change in distance can be found by solving the following equation:

$$\frac{A'_{ij}}{A_{ij}} = \frac{e^{(a+b*C)} \text{ (Distance}')^{d}}{e^{(a+b*C)} \text{ (Distance)}^{d}} = \left(\frac{\text{Distance}'}{\text{Distance}}\right)^{d}$$

where $A'_{ij}$ is the new level of per capita applications and (Distance') is the new distance.

Solving this equation shows the proportionate change in applicants equals the proportionate change in distance raised to the coefficient d. Given the regression equations for each program, a five-percent increase in the average distance to parcels results in an approximate three percent decline in per capita demand in all programs.

This assumed change in supply has a significant effect on the quantity demanded. In the high case, the average quantity demanded falls from 64,000 acres to 60,000 acres, a 6 percent change. In the low case, the average yearly quantity demanded also falls by 6 percent. An average increase in distance of 5 percent each year after 1981 results in a decline of 6 percent in the average quantity demanded.

This approach can be used to examine the effect of any given change in distance. If the distance to one type of land changes, the effect can be measured with this approach. (Appendix C illustrates the effect of a change in distance on the demand for particular types of land.)

Table 16 illustrates the effect of a change in the other dimension of supply, the quality dimension. In this table, we examine the effect of removing a type of land which has been offered in past state disposals. In this forecast, we assume that no more land is offered in Southeast Alaska. Location in this area seemed to be an important quality dimension which was described by our regression equations.

The effect of the elimination of this land type on the aggregate demand for land will depend on the consumer's recognition of the existence of substitutes for this type of land. A change in one type of land available will affect the demand for all other types of land, for close substitutes of eliminated type of land demand will increase. Unfortunately, the current specification of our demand equations does not allow us to examine the effect of changes in substitutes directly.

Table 16 examines the effect of eliminating Southeastern land under two assumptions about substitutes. First, we assume Southeastern parcels are a completely separate market and have no substitutes in the state offerings. Under this assumption, those applicants for land in Southeast simply drop out of the state land disposal program if no Southeast land is offered. The second assumption is that substitutes do exist and that some applicants shift demand to the next best alternative.

TABLE 16. THE EFFECT OF CHANGE IN SUPPLY ON QUANTITY DEMANDED
SOUTHEAST ALASKA

(Yearly Average 1981-1985)

| | Applicants | | | | | Acres | |
|---|---|---|---|---|---|---|---|
| | With Southeast Parcels | Without S.E. Parcels Substitution | Net | Without S.E. Parcels No Substitutes | Net | Without S.E. Parcels Substitution | Without S.E. Parcels No Substitutes |
| **High Scenario** | | | | | | | |
| Subdivision | | | | | | | |
| Large | 1,165 | - 452 | 713 | - 544 | 621 | 17,825 | 15,525 |
| Small | 4,468 | -1,286 | 3,182 | -2,118 | 2,350 | 12,728 | 9,400 |
| Remote | 366 | -- | 366 | -- | 366 | 12,444 | 12,444 |
| Homesites | 1,279 | - 149 | 1,130 | - 258 | 1,021 | 4,068 | 3,676 |
| | | | | | | 47,065 | 41,045 |
| **Low2 Scenario** | | | | | | | |
| Subdivision | | | | | | | |
| Large | 881 | - 370 | 511 | - 443 | 438 | 12,775 | 10,950 |
| Small | 3,442 | -1,055 | 2,387 | -1,717 | 1,725 | 9,548 | 6,900 |
| Remote | 199 | -- | 199 | -- | 199 | 6,766 | 6,766 |
| Homesites | 943 | - 123 | 820 | - 209 | 734 | 2,952 | 2,642 |
| | | | | | | 32,041 | 27,258 |

The substitution effect can be approximated from the demand equations estimated above in much the same way that the effect of a change in distance was estimated. The substitution effect is the net change in demand which results from the reduced quality and the change in distance to the substitute parcel. To measure the substitution effect, we need an assumption which describes the next best alternative; the next best alternative is assumed to be the closest available, similar type of land located outside Southeast Alaska. The change in per capita demand can be estimated with the following formula:

$$\frac{A'_{ij}}{A_{ij}} = \frac{e^{a+b_1C} \quad (\text{Distance}')^d}{e^{a+b_1C+b_2C_{SE}} \quad (\text{Distance})^d} = \frac{1}{e^{b_2C_{SE}}} \times \left(\frac{\text{Distance}'}{\text{Distance}}\right)^d$$

where the symbols are the same as above except that $C_{SE}$ represents the set of characteristics if the land type is in Southeast.

The elimination of Southeastern parcels in the offering would reduce the quantity demanded whether or not there was substitution. Without substitution, the yearly average quantity of land demanded would fall to 41,000 acres in the high scenario and 27,000 acres in the low scenario; this is 36 percent below the constant supply case in the high scenario and 41 percent below in the low scenario. As in the case of distance changes, this approach could be applied to any other change in the quality of land offered.

In both examples, changes in the supply of land offered by the state had a significant effect on the quantity of state land demanded. Changes in the supply of private land will also affect the quantity of state land demanded since private land is a substitute for state land. The origin dummies in our demand equations were supposed to account for the effect of private market differences. Unfortunately, there is no clear interpretation of these variables, so the demand equations cannot be used to examine the effect of private supply.

We would expect that continued state disposals would lead to changes in private supply of land in two ways. First, state offerings may affect the supply price of private land as owners reevaluate future expected earnings. Secondly, past state disposals may enter private land markets; this will result in the availability of private land in types and areas not previously available.

There are a number of reasons to believe past state disposal land may be placed on the private market and may provide effective competition for future sales. First, the turnover in the population has already been mentioned. Those leaving Alaska who have won land in past sales may wish to sell their land. Second, winners of large subdivision parcels may subdivide, creating additional parcels from past sales. Third, the discount program may provide an incentive for selling since selling it allows residents to cash out their residency discount. Fourth, the ease of entering the state land market, the lottery method of selection, and the low initial monetary commitment may result in many applicants' winning land without a clear idea of

the real costs involved. Once winners realize the full cost of using state land (i.e. travel costs, taxes, development costs), they may wish to sell their land. Finally, the competition from past sales will be effective if the quality of state land does continue to decline. Past offerings will provide better quality or lower cost land.

Table 17 illustrates the effect of one assumption about the past disposal land entering the private market. Under the assumption that one-quarter of all past subdivision land enters the private market, approximately three-quarters of the average yearly demand for state land could be handled by the private market by 1985. If one-third of the land were offered on the private market, the need for state disposals would be eliminated after 1985.

## Future Use

This section will describe in general the steps to be taken to implement the land demand model as a useful planning and management tool for DNR. We will assume throughout this section that the ultimate aim of DNR is to replace the ad hoc forecasting approach of the last section with the direct use of the land demand equations. The suggestions in this section will reflect both our theoretical understanding of land markets and the application of the methodology described in the last section. A starting point for the development of this new methodology is a discussion of the problems of the projection methodology.

TABLE 17. DEMAND FOR LAND (1981-1985)

CHANGE IN COMPETITION[1]
SUBDIVISION LOTTERY

| | High Case | | | $Low_2$ Case | | |
|---|---|---|---|---|---|---|
| | Demand | Past Sales | Net Demand | Demand | Past Sales | Net Demand |
| 1981 | 5,633 | 2,888 | 4,911 | 4,323 | 2,888 | 3,601 |
| 1982 | 5,633 | 7,799 | 3,683 | 4,323 | 6,489 | 2,701 |
| 1983 | 5,633 | 11,482 | 2,762 | 4,323 | 9,190 | 2,026 |
| 1984 | 5,633 | 14,244 | 2,072 | 4,323 | 11,216 | 1,519 |
| 1985 | 5,633 | 16,316 | 1,554 | 4,323 | 12,735 | 1,139 |

[1]Assumes one-fourth of past sales enter land market each year in competition with state disposals.

The problems of the projections in the last section occur on three levels: problems with projections in general, problems with the use of sales data, and problems with the particular methodology. Although it is important to review the first two sets of problems, the third provides the base for suggested changes in future applications.

Projections provide a description of a future level of activity, in this case, the future private demand for state land. Projections cannot be assumed to be an accurate description of what will happen, but rather a description of what could happen if the set of assumptions on which the projections are based comes true. Projections are probabilistic.

All methods for making projections require assumptions about the future. The simplest projection technique is simply to assume a certain growth for each of the major variables. More complex techniques employ some form of model to translate assumptions about specific events into projections. Models describe the relationship between variables about which assumptions are made and those for which projections are made; an important assumption when a model is used is that the relationship described by the model remains constant. The use of models makes explicit the assumptions implicit with simpler techniques and provides a way of examining the effect of alternative assumptions.

Uncertainty attached to the projections because of uncertain assumptions is the primary problem with using projections. There are two ways to limit the importance of this problem, although uncertainty

can never be eliminated from projections. The first measure is to provide a clear, complete description of the assumptions on which the projections are based; this allows users to know exactly what is behind the projections. The second measure involves producing many alternative projections instead of one; these alternatives provide an indication of the effect of altering major assumptions. These measures do not limit the uncertainty of any particular projection, but they allow the establishment of a range of possible outcomes which the researcher expects to have a high probability of occurrence.

The second set of problems with this projection technique involves the use of the sales data from the land disposals. There are three important data problems. The first involves the assumptions required to use the data. The need to assume an absence of any "land rush" mentality has been discussed. To the extent that this occurred in the first disposals, the projections will overestimate demand. Although this is a problem, as more sales occur, any unusual participation in the first sales can be tested for and corrected. We also must assume the disposals represent a separate land market. If they do not, we will underestimate demand since we are ignoring the private portion of the market.

Another major set of problems with the data is its limitations. The models developed reflect only the land types and disposal techniques available in past sales. The inclusion of the characteristics in the demand equation theoretically allows us to estimate the effect of other bundles of those characteristics. However, we

cannot estimate the effect of characteristics which have not existed in previous sales. For example, we could not estimate the demand for completely improved subdivision land. This limits the ability of the methodologies to address specific policy questions.

Finally, the existing data does not capture all of the information about demand in the state land sales. Two important pieces of information about the existing sales which will affect demand are the turndown rate and use of discounts. Information on the use of discounts was available only by a survey of contracts. A full survey was a much larger task than could be undertaken by this project; such a survey would only provide information on the winners. Discount information on all applicants is necessary to specify correctly the price applicants pay. The turndown rate is another important piece of information. Our projection of demand is based on applicants. If a substantial portion of these applicants do not accept the land they win, this will reduce the effective demand for land. The turndown rate may be significant if the pattern of shopping is such that buyers investigate the land fully only after winning it. The data has been adjusted for multiple applications by individuals but not by households. If more than one member of a household applied for a parcel to improve the household's chances of winning, demand would be overestimated. Also missing from the sales data is any information on the socioeconomic group of the applicant and the probable use of the land. This information is necessary to properly account for the effect of tastes and attribute productivity on demand.

Problems with the technique itself are primarily problems with the definition of variables used in the per capita demand equations. The first two concern how demand is defined. The most important aspect of this methodology is that it allows us to examine the effect of supply on the quantity demanded. In the present exercise, the observations included in the regression included only those cases when the number of applications for a land type from an origin were greater than zero. This ignores very important information, the zero applications. It is important to know under what combination of land types, prices, and distance no land will be demanded. Ignoring this information overestimates the demand for land.

The second problem of definition involves land types. Whenever characteristics are used to classify types, there is always the possibility that important characteristics may have been ignored. Our assumption that the distribution among parcels within a given type is random may not be true. Additionally, our definition of characteristics may not be accurate. For example, we had originally defined three types of access for subdivision land: direct road access, less than two miles, and other. In estimating the demand equations, direct road access had a negative effect, which did not seem reasonable. After some investigation, we found direct subdivision access was an important characteristic, but people preferred to be off the main highway. This seems reasonable and necessitates a redefinition of "direct" access. These problems mean the definition of land types must be reexamined and also may explain the lack of significance of some of the characteristic variables in the equations.

The final methodological problem involves the definition of substitutes used in the regression equations. Dummy variables which describe the origin of the applicant were used to account for differences in the available substitutes. Although this approach may account for the effect of regional variation in substitutes, this specification is not very helpful for projections. A projection technique must be able to account for the effect of changes in available substitutes on the quantity demanded for particular types of land.

Changes in available substitutes will be of two types. First, each disposal will have a different combination of offerings. This set of offerings provides one set of substitutes for each type of land offered. The second set of changes in substitutes will be changes in the private land available. The private land available will change; as existing vacant land is used up, the price of available private land will increase. Available private supply will also increase as past state disposals become part of the private land market; this will counteract the upward pressure on land prices. Finally, state offerings may affect the offer price of private land by changing private land owners' expectations about future land prices.

Implementation Plan

One goal of this study has been to suggest a workable methodology for forecasting the private demand for state land. The approach used in this study can be considered an initial step toward that goal. We have shown that demand equations for state land can be estimated for

state land sales data. The regression equations presented in this paper are not intended for direct adoption and use in the state's planning process. The goal of further work on this methodology should be to replace the ad hoc forecasting approach used in this paper with the direct use of the demand equations in the forecast.

Improvement in the estimated demand equations will come with the increased availability of information on land markets and the state's role in these markets. Information will come as more state sales are held. Additional information will have to be collected from other sources. The demand equations should be continually updated as additional sales are held and other land market information is obtained. Improvement in this methodology should become an integral part of the DNR management program.

This section discusses an implementation plan for improvements to the demand methodology. Improvements will result primarily from changes in the specification of the model and additional data collection. Data collection and model specification cannot be considered independent aspects of the problem since lack of data often limits the choice of model specification. Changes in model specification and the required data collection are discussed below.

Three major areas are available for improvement of the demand model: the definition and treatment of land types, the inclusion of the effects of substitutes, and the further definition of applicants' characteristics.

1. Land Type Definition. Ideally, land types should be defined to represent separate but related land goods. Sufficient enumeration of land attributes will allow us to place all kinds of land which consumers seek into separate, distinct categories. Consumers choose land by selecting the most convenient parcel having the attributes important to them, considering the availability of other parcels having other attributes. If land types are adequately defined, we will find few consumers who knowlingly pay a higher price than necessary for a given land type. Consumers will purchase the parcel of land in each type which has the lowest combined cost of purchase.

In our analysis, the land types were described by the combination of four types of characteristics: road access, water access, community access, and size. Although these are important parcel attributes, they do not define all possible land types. The past sales data showed some bypassing of closer land of a particular type which was lost in our aggregation.

Improved definition of land types could result from defining additional parcel characteristics, redefining the characteristics used in this study, and reflecting the variation in price and acreage. Additional parcel characteristics may include such things as environmental conditions and constraints and various types of recreational potential. Our work has also suggested better definitions of the set of characteristics used in this study. Road access to the subdivision is probably a better explanatory characteristic than road access to the parcel. Water access should be distinguished between ocean, lake,

and stream access. Finally, the only variation in price and acreage accounted for in this study was the variation of averages across land types and regions. Land types should be disaggregated to reflect more variation in price and acreage. The important set of attributes which defines land types may differ across programs; different parcel characteristics may be more important for the remote parcel than for homesites. The effect of the examination of these additional characteristics will be to define more types of land.

Significant land type characteristics can be defined in two steps. First, the complete set of possible characteristics must be defined. DNR personnel with direct experience in examining parcels are probably the best judges of what this set includes. From the complete possible set, a preliminary set of characteristics can be defined on the basis of theory and experience. The second step will incorporate land characteristic information with application data. To determine the most descriptive set of parcel attributes, DNR will have to determine which parcels people apply for in relation to the availability of other parcels. By reclassifying the types of land available, using different sets of attributes, the effect of various attributes can be tested. If a set adequately describes the types of land available, we expect the consumer to apply for the most convenient site (for all but investment uses). The best set of characteristics can be chosen so that applicants fit this hypothesized pattern of application. For example, selection of the set of land characteristics could be based on a procedure which added characteristics until no more than some chosen percentage of applicants bypassed a closer parcel of a given type.

2. Substitutes. The demand for any type of land offered in the state land disposal program is a function of the availability and price of other types of land. Substitutes include both state land and land in the private market. A full description of the available substitues is needed to properly specify the demand model.

In the present model, the effect of substitutes was represented by dummy variables which represented the region of origin of the applicants. It was hypothesized that there was a significant regional difference in available substitutes. Although this may be true, this specification does not allow us to examine the effects of changes in the availability of substitutes. This is necessary if the model is to be used to forecast future demand for state land.

Correctly specifying and including the substitute terms in the demand equations involves problems of data collection and definition. The cost of purchasing substitutes is the correct way of including them in the equations. For private land, this would include defining a set of private land types and defining available substitutes by the cost of purchasing each type in each origin or census division.

The major problem involved in attempting to include private market substitutes is data collection. There is no single source of information on the private land markets; what information does exist is of varying accuracy and is located in many different places. One alternative for collecting this information is to let appraisers in each area of the state estimate the cost of various type of private

land in each market area. This process could be incorporated into the appraisals which are conducted to set prices for each disposal. Apppraisers, theoretically, collect market data to establish comparables when they assign prices to the parcels in the lotteries.

An alternative approach would be to rate the availability of substitutes in each market area. Substitutes may be rated on a number of dimensions which would be proxies for price and availability. Variability in these dimensions across origins would exist. By assuming some change in the future substitute ratings in a market area, we could use this to forecast future demand.

The problem with including other state offerings as substitutes is more complex; it is a problem of definition. In the present study, we attempted to use many alternative definitions of the effect of other land types offered in the disposal. None of our experiments provided satisfactory results. One reason for this may be that the current disposal offerings are not the correct definition of state land program substitutes. Consumers may consider all possible state offerings as substitutes. Since a consumer may participate only once every eight years, he may wish to wait until land he thinks the state will offer is available. If this is the case, current disposal offerings do not completely describe state land substitutes.

The proper definition of state land substitutes requires further investigation. With more sales, the effect of other current state offerings can be examined, assuming land offered in each disposal is

the appropriate set of substitutes. Another approach may be to include a set of substitutes defined by all past disposals; this assumes consumers' expectations about future disposals are determined by past disposals. A final approach may be simply to rate the availability of state land in each market area. These ratings would reflect potential state disposals.

3. Applicant Characteristics. A correct specification of the land demand model would account for the effect of differences in tastes, potential use of the land, and income on demand for each type of land. The effect of tastes and income are traditionally accounted for by examining the effects of the socioeconomic characteristics of the consumer on demand. Income and tastes will both determine participation in the program and the importance of various land parcel attributes. The importance of various parcel attributes will differ depending on the consumer's potential use of the land.

In the current study, these aspects are not specifically addressed. The origin dummy variables may account for some of these differences if tastes, incomes, and uses differ significantly by region. To take these factors explicitly into account requires additional information about the applicants. In this study, we had no information describing how applicants were distributed in any way but across regions.

There are two approaches to collecting this additional information. The first approach would be to collect the information when the

applicant applies for the land. This would provide disaggregate applicant data for all future sales. A second approach would be to survey past applicants. This survey would be extremely useful in the land disposal planning process.

By emphasizing the disposals between Spring 1979 and Spring 1980, the survey may allow us to say more about who participates. DNR could compare a distribution of applicants by socioeconomic and income groups to the distribution shown in the census to examine what proportion of the different groups participate in each program. The distribution of types of uses of the land (i.e. investment, residential, recreational) by socioeconomic group could also be found.

A survey could provide additional helpful information on the demand for land. First, a survey could better assess the potential discount on the parcel price. This information could be incorporated into the demand analysis. Secondly, a survey could be structured to provide additional information on how consumers view land markets. For example, information on the nature of substitutes and importance of parcel attributes could be assessed through a survey.

A survey could also address specific policy questions. One important question is how demand would change if there were no limit to participation. In addition, respondents could be asked to estimate when and how they plan to use parcels. Answers to this question would be helpful for planning the public investment response to these disposals.

One final problem concerning the definition of applicants concerns the treatment of past winners. Given the eligibility requirements of the program, past winners cannot participate in future disposals. In the present study, the per capita demand regressions ignored past winners; this may not have presented a major problem in these regressions because of the small number of past winners. Winners, however, should be accounted for in future analyses. One way to treat winners may be to add winners by land type from the previous sales to the applicants in each sale analyzed; this would reflect total demand for that land type at any point in time. This approach was used in the development of the per capita demand parameters used in the present forecast; past winners were then subtracted from projected future demand. This method would be appropriate except for the effects of population turnover. If past winners leave the state, this method will overestimate per capita demand. One alternative solution would be to include the number of past winners from an origin as an explanatory variable in the regressions; the regression coefficient would reflect the effect of population turnover on the per capita demand. Projections would not have to be adjusted in this case.

## Recommendations

The purpose of this section is to suggest specific steps DNR should take to implement the demand methodology. DNR's goal should be to develop a set of regression equations which can be used to forecast the per capita demand for land, given the supply offered. The following steps are recommended:

1. Define demand origins. DNR must define a set of sub-regions in the state from which demand originates. These origins should reflect similar land markets and socioeconomic characteristics. They should also account for spatial variations in future disposals and should be small enough so that distance can be reasonably measured.

2. Define a comprehensive set of land types. These types should reflect a set of land parcel characteristics which distinguish land parcels for consumers. One approach would be to develop a list of potential characteristics which DNR personnel and survey information may suggest are important. Start with the smallest set which DNR feels may distinguish land types or which may be important for policy purposes. Examine applications from each origin for their distribution across parcels within a given land type. If more than a certain percentage bypass the closest group of sites, add more characteristics to distinguish more types. The complete set of land types will be defined when the distribution of applications has less than a defined proportion of crossovers.

3. Distinguish size and price groups. Parcel types should also include variation in price and size of parcels.

4. Define demand by origin. The number of applicants for each type of land for each sale (even when there are no applicants) should be found. This requires investigating the hypothesis that people always apply for the same type of land. This could be done by examining the multiple applications to see if applications cross parcel types.

5. Define travel cost to land types. The distance to each land type from each origin should be measured. Distance should relate to the most appropriate mode of travel: air, road, boat. Travel costs per mile by appropriate mode should be applied to these distances.

6. Updating procedure. Once a set of characteristics and origins is defined, DNR should incorporate this demand information in its data keeping procedures.

7. Survey past applicants. Certain information which may affect demand can only be determined by survey. This includes use of discounts, potential use of the land, and applicant income. These as well as policy questions could be addressed.

8. Define substitutes. The potential for substitutes, both private and public, must be defined. The easiest approach would be to rate the substitute potential from

each origin. A scale or index could be developed for types of land, which is a proxy for availability and price. Such a rating could be developed by real estate people and DNR land managers.

9. Estimate regressions. DNR should estimate demand regressions which incorporate the most recent sales information. These regressions should be specified to examine variation in the structure of demand, across regions, over time, and for types of land. New information and specification should be incorporated until the regressions explain a large portion of the variation in demand and the regressions appear stable across sales. Once the regressions are developed, they can be used to project the per capita demand for various types of land from each demand origin.

10. Forecast the quantity of land demanded. Forecasts of demand could be made using the per capita demand equations, estimates of the supply of land available, and forecasts of the population growth. A set of forecasts describing a reasonable range of assumptions should be made. Forecasts should be updated regularly.

## Conclusions

This study has presented a methodology for forecasting the private demand for state land in each of three disposal programs: subdivision, remote parcel, and homesite. The forecast methodology suggested consists of two parts. First, demand equations were suggested to estimate the per capita demand for state land. The demand equations can be estimated from past state sales information. Further work on equation specification and the inclusion of additional data should improve these equations. The second part of the methodology consisted of forecasting demand by applying the forecast of per capita demand to a forecast of population growth.

The methodology provides a usable approach to estimating the quantity of land demanded. More work is needed on the regression equations, but we feel this will provide a useful tool for DNR. The approach also defines a management tool since it provides a way of organizing information on past sales.

This paper also includes a set of forecasts describing the future average annual quantity of land demanded over the period 1981-1985. These forecasts were derived using a procedure based on the methodology described in this paper. A set of projections was made which reflects a reasonable set of assumptions about population growth, the supply of state land, and competition from the private market. In all cases, the demand was substantially below 100,000 acres per year. We also showed that changes in the supply of land available would have a significant effect on the quantity demanded.

The set of projections is necessary because of the uncertainty inherent in the important assumptions. Each forecast reflects a particular set of assumptions; no one projection can be assumed to represent the exact level of future demand. Hopefully, these forecasts present a reasonable range of potential demand which is useful for planning and management purposes. The forecast will be improved and the range narrowed as the methodology is improved.

One additional comment should be made concerning the interpretation of these forecasts. An implicit assumption is made that all the demand should be met in this five-year period. This assumption is responsible for the high level of demand projected since there is a large demand from the existing population. If this demand were met over this period, yearly average demand would decline to at least half this level after 1985. If the policy were to meet this demand over some longer period, yearly demand would be lower.

One important finding of our analysis is that the quantity of land demanded cannot be projected without some notion of the supply of state land offered. Forecasts of demand must be associated with some description of potential supply. Supply varies in two important dimensions. First, the cost of parcels offered differs; costs reflect the purchase price, travel cost, and other costs of use. Secondly, the quality of parcels differs. Different parcels have different characteristics which describe their productivity in various uses. Changes in the supply of state land available will result in changes in the quantity demanded over time.

The most appropriate planning use of this land demand model is defined by this relationship between supply and the quantity demanded. The land demand model should be used in conjunction with an inventory of available state land. With an inventory of the types of land available, the potential for a decline in the quality of the offerings could be assessed, and the effect of this change in supply on demand could be forecast.

There are two important policy issues which our analysis can be used to address. The first of these issues involves the price policy implicit in the state land disposal program. A state land disposal policy which attempts to satisfy the demand for land must also contain a specific price policy. We have shown that a considerable excess demand exists for certain types of land. This excess demand exists at the price at which the state is making the land available. In a regular land market, excess demand would be eliminated by the adjustment of price; land parcels would go to the highest bidder. The state must realize there are both quantity and price dimensions of its land disposal policy. The state can satisfy demand by either providing more land at a fixed price or by raising the price of land it offers.

An additional reason an explicit price policy is needed is that state land sales affect the price of private land. State sales affect private land by increasing the stock of available private land and changing the current owners' expected future gain, which also changes the land offered for sale. To the extent that state land provides substitutes for private land, state land sales will have a depressing

effect on the price of private land. The potential of this effect means prices should not be overlooked in setting state land policy.

The second policy issue relates to other potential uses of state land. Private residential and recreational use of state land through disposal is only one of many potential uses of the land. Other private productive and extractive uses, as well as public uses such as parks, are also important. The methodology developed in this study addresses only the private residential and recreational demand for state land; this does not suggest that state land policy should be addressed simply to meeting this demand.

Competition between uses will be especially important if good quality state land which could accommodate many uses is limited; in this case, the economic problem is to allocate the scarce commodity (land of good quality) among many uses. The land demand model in this study can be used to measure the effects of alternate allocations of state land on the proportion of private demand which is not met. Methods must also be developed to assess the demand for land in other uses and the effect on this demand of alternate allocations of state land so that the optimal use of state lands can be achieved.

# APPENDIX A

## SELECTION OF DEMAND ASSESSMENT METHODOLOGY: STATE LAND DISPOSAL PROGRAM

The following tables outline the suggested techniques for assessing land demand. These techniques are described in terms of the steps in the process, the data requirements and sources, the uses of the product, its strengths and weaknesses, and its cost.

APPROACH: End Use (Minimum Cost Allocation)

| STEPS | DATA REQUIREMENTS AND SOURCES |
|---|---|
| 1. Determine market areas. Market areas include a common origin of land transactions (i.e., the Anchorage market). | 1. Informed sources such as real estate people. |
| 2. Project macrodeterminants of land consumption by market area. Macrodeterminants include population and employment by major subgroups (i.e., age groups, households). | 2. Use existing economic forecasting models such as ISER's MAP model. |
| 3. Define parameter values which describe consumption of land of each type by a consumer in each major subgroup in the population (i.e., the average acres consumed for recreational cabins by a household with household head aged 25-35). | 3. Assumptions based on existing information such as census, land use surveys, and national studies. This information would have to be adjusted to reflect the change in land market conditions resulting from the disposal program.<br><br>or<br><br>Survey of Alaska population. Respondents would be asked whether they would purchase land, for what use, how much, and the maximum price they would pay. |
| 4. Allocate aggregate land consumption to regions. This can be done by assuming consumption is allocated to minimize costs which include purchase price, development costs, and travel. The distribution would depend on the existence of available land. | 4. Inventory of existing available land. Such information may be available from existing land use studies and the DNR planning process. |
| 5. Estimate investment demand. A time dimension is necessary for estimating this. Assuming an average holding period, projection of future use can be converted to a current investment demand. | 5. Average length of holding land prior to development. Real estate or land development industry sources. |

APPROACH: End Use (Minimum Cost Allocation) (continued)

STEPS

6. Estimate consumption of state land. Once regional consumption is known, state land consumption would equal total consumption minus existing use minus available private land.

DATA REQUIREMENTS AND SOURCES

PRODUCT

1. Projection of components of private land consumption by market areas. Components include urban residential, rural residential, and rural recreational uses. Projection could be for a number of years in the future.

2. Allocation of consumption to region of consumption.



STRENGTHS

Without Survey

1. Easy and cheap.

2. Can be used to test the sensitivity of alternate assumptions about consumption.

With Survey

1. Estimates current potential consumption.

2. Data collection does not have to occur each year.

WEAKNESSES

1. Assumed nature of parameters.

2. Inability to account directly for the effect of changes in types and amount of land available for use.

1. Same as 2 (without survey).

APPROACH: End Use (Land Preference Allocation)

## STEPS

1-3. Same as End Use (Minimum Cost Allocation).

4. Allocate aggregate land consumption to regions. Use ranking by preference for types of land; to do this:

   a. rank land types by preference
   b. allocate consumption to most preferred land types first, then to second.

5-6. Same as End Use (Minimum Cost Allocation).

## PRODUCT

1. Projection of components of private land consumption by market area for various types of land.

## STRENGTHS

1-2. Same as End Use (Minimum Cost Allocation).

3. Incorporates the effects of different types of land (the difference in the attributes of land parcels).

## DATA REQUIREMENTS AND SOURCES

4. Ranking of land by consumer preferences. Requires sample of raw land sales. The price of land is regressed against the land characteristics, and this equation can be used to rank types of land by preference.

## WEAKNESSES

1-2. Same as End Use (Minimum Cost Allocation).

APPROACH: Land Absorption

| STEPS | DATA REQUIREMENTS AND SOURCES |
|---|---|
| 1. Determine the market areas. Market areas are defined to include the origin and location of the majority of land transactions in the region. | 1. Informed sources. |
| 2. Project population by subarea of market areas. | 2. Use existing economic forecasting models. |
| 3. Define the absorption potential of subareas of the market. Absorption potential is the proportion of vacant land which will be consumed (put into use) over a year. | 3. Past land absorption is a proxy for absorption potential. Past land absorption can be measured from one of two sources:<br>a. Comparison of Enumeration District housing counts between the 1970 and 1980 census will provide a proxy for land absorption.<br>b. Examination of assessors' records or aerial photos to compile picture of land absorption. |
| 4. Relate past absorption to characteristics of the market area and subregion. Such characteristics are changes in market area population, distance from employment centers, physical infrastructure. | 4. Inventory of important characteristics by subarea from DNR planning process. |
| 5. Given the projected change in market area population, project absorption potential for each subarea. Multiply by the amount of vacant land in the area to get land consumed. | 5. Inventory of available vacant land. |

APPROACH: Land Absorption (continued)

## STEPS

6. Estimate investment demand. (Same as in end use approaches.)

7. Estimate yearly consumption of state land equal to total land absorbed minus available private land in the subarea.

## DATA REQUIREMENTS AND SOURCES

## PRODUCT

1. Projection of yearly change in the consumption of land (absorption) by subareas of the state.

## STRENGTHS

1. Accounts for the effects of changes in demand and supply on consumption. Change in population approximates changes in demand pressure, while change in available vacant land approximates changes in supply.

## WEAKNESSES

1. If census data is not used, this method has a large data requirement.

2. If census data is used, the application must wait until this data is available (spring or summer 1981).

APPROACH: Conversion

| STEPS | DATA REQUIREMENTS AND SOURCES |
|---|---|
| 1-3. Same as Land Absorption approach. | |
| 4. Relate past absorption to characteristics of market area and subarea. In addition to characteristics in Land Absorption technique include relative prices, in which average price of available land in a subarea is taken relative to some standard area. | 4. Inventory of important characteristics and average price of land by subregion. Land price information can be obtained from sampling assessor files. Another approach estimates a regression from assessor's sales files which describe price as a function of the characteristics of land parcels and applies this regression to the average characteristics of each subarea. |
| 5-6. Same as Land Absorption approach. | |
| 7. Estimate yearly consumption of state land. In each subarea, assume price of state land is less by the average discount. | 7. Average amount of residency discount on state land sales. Sample past land sales to estimate discount value. |



PRODUCT

Same as Land Absorption approach.

| STRENGTHS | WEAKNESSES |
|---|---|
| 1. Includes the ability to account for the effect of price on absorption. | 1. Increasing data requirements over Land Absorption approach. |

APPROACH: Sales

| STEPS | DATA REQUIREMENTS AND SOURCES |
|---|---|
| 1. Define market areas which are regions from which demand originates. | 1. Informed sources. |
| 2. Project population by market area. | 2. Use existing economic forecasting models. |
| 3. Separate land offered in past sales into land types distinguished by the attributes of the parcel. | 3. Based on land sales brochures and physical inventory of land from DNR planning process. Separate into important land types based on analyses of sales patterns and interviews with knowledgeable sources. |
| 4. Estimate demand schedule for each land type from past sales information.<br>a. Group applicants for each type of land by market area (adjust for multiple application).<br>b. Find total price for each parcel; includes purchase price less discount plus average travel cost.<br>c. For each land type, a demand curve can be found by mapping the full price and the per capita number of applicants from each market area. | 4. The basic information comes from DNR's application list for the past three lotteries. The use of discount can be estimated by sampling past sales and relating discount use to area of residence and value of parcel. |
| 5. Project demand for state land. Based on estimate of average price of each type of land in subareas of the state, find the per capita demand from each market area. The per capita demand times the population projection equals the total demand for state land. | 5. Price of land by subarea. Based on appraiser's estimate or a price regression as described in Conversion approach. |

APPROACH: Sales (continued)

PRODUCT

1. Yearly estimate of the demand for state land of various types by subarea of the state.

2. Technique for analyzing the effectiveness of each successive sale. As sales occur, the technique can be improved through the addition of new information.

STRENGTHS

1. Readily available data not subject to the limitations of most land sales data.

2. Ability to improve technique as more sales are held.

WEAKNESSES

1. Confusion about time dimension. Can sales information be interpreted as yearly or total demand of the population?

2. Some types of land which the state possesses may not be included in past sales, so only limited information is available.

APPROACH: Willingness to Pay

| STEPS | DATA REQUIREMENTS AND SOURCES |
|---|---|
| 1. Define market areas which are regions from which demand originates. | 1. Informed sources. |
| 2. Project population for each market area for major demographic and socioeconomic groups. | 2. Use existing economic forecasting models. |
| 3. Define important land types as a function of parcel attributes. | 3. Informed sources, analysis of past sales, and analysis of survey results (see 4). |
| 4. Determine ranking of land types by preference and the maximum willingness to pay for each consumer group for the most preferred type. | 4 and 5. This information would be based on a survey of the population which would ask respondents to rank types of land and types of land/price combinations. The survey would also ask the respondents' maximum willingness to pay for the preferred types of land. |
| 5. Determine relative prices for land types at which consumers in each group are indifferent between types. | |
| 6. Define price facing each consumer group for each land type. | 6. Prices based on appraiser's estimate or price equation. Price would include purchase, travel cost, and (for state land) the discount. The price facing any consumer would equal the cheapest full price for each type of land. |
| 7. Estimate the demand for state land using the following rule: Consumers will choose their most-preferred type of land unless the price is greater than the maximum willingness to pay, or the relative price of a substitute is such that the consumer would prefer the other type. If the price of all available types of land exceeds the group's maximum willingness to pay, no land will be taken. | |

APPROACH: Willingness to Pay (continued)

STEPS

8. Demand facing the land program would equal the demand for each type net of available private land at the assessed price.

PRODUCT

1. Estimate of the yearly demand for state land of various types. Each year demand would depend on the change in the population plus the unmet demand from previous years.

STRENGTHS

1. Accounts for the effects of both prices and substitutes.

2. Provides information on types of land and price relationships which may not be available from observing land sales.

DATA REQUIREMENTS AND SOURCES

8. Inventory of available land.

WEAKNESSES

1. Survey measures attitudes.

2. Methodology is experimental.

Following is a list of the variations of each methodology. The methods are listed in order of their relative cost, with the cheapest listed first. The three most important determinants of cost are data collection, surveying, and data manipulation; each of these is rated no effect (O), high (H), moderate (M), and low (L) for each method.

| | Cost | | |
|---|---|---|---|
| | Data Collection | Survey | Data Manipulation |
| 1. End Use - Assumption - minimum transport cost allocation | L | O | L |
| 2. Sales Approach | L | O | M |
| 3. Absorption Approach - census data | M | O | M |
| 4. Absorption Approach - other data | H | O | M |
| 5. Conversion Approach - census data | H | O | M |
| 6. Conversion Approach - other data | H | O | H |
| 7. End Use - Survey - minimun transport cost allocation | H | H | M |
| 8. End Use - Survey - land preference allocation | H | H | H |
| 9. Willingness to Pay | H | H | H |

The recommendation of the report is that DNR develop a two-phase approach to the projection of demand. This approach would select a low-cost approach for the short run while developing a more sophisticated technique for the long run. The approaches we recommend are the sales approach for the short run and the willingness-to-pay approach for long-run development.

Our choice is influenced primarily because these techniques measure demand. These techniques would allow DNR to assess the effect of changes in supply on the amount of land consumed. Consumption techniques and those which are based on past private land activity cannot account for the structural change caused by the state disposal program.

There are other practical reasons for our recommendation. The sales technique is one of the easiest to implement; data is available through DNR. One problem with this approach occurs because the recent start of the disposal program may cause a rush to buy land which does not reflect yearly demand. Another problem may occur if the state has not offered all land types. As the program continues, the structural change aspects will diminish, as people become more certain of the program, and the demand schedules estimated will approach, more closely, the true yearly schedule.

The willingness-to-pay approach, although the most expensive, describes demand for land most completely. The use of the willingness-to-pay approach fills in the holes of other approaches and identifies preferences for types of land which may not be available in the land market. The importance of this approach is a function of the incompleteness of information provided by the sales technique. The willingness-to-pay approach complements the short-run development of the sales technique. The results of the willingness-to-pay approach will also allow DNR to determine the effects on demand of policy changes. For example, the effect of a policy change in which the state would improve parcels could be assessed.

TABLE B-1. LAND TYPES

| | |
|---|---|
| 1 | Large, less than two miles from road, water access |
| 2 | Large, more than two miles from road, water access |
| 3 | Large, less than two miles from road, no water access |
| 4 | Large, more than two miles from road, no water access |
| 5 | Small, less than two miles from road, water access |
| 6 | Small, more than two miles from road, water access |
| 7 | Small, less than two miles from road, no water access |
| 8 | Small, more than two miles from road, no water access |

TABLE B-2. DISPOSAL AREA DESCRIPTION

| Subdivisions | Disposal Areas | Land Types | Region* |
|---|---|---|---|
| Fall 1979 | | | |
| | Gustavas | 1, 3 | SE |
| | Willow Creek | 7 | I |
| | Glennallen | 3, 7 | I |
| | Tok, Warren | 3 | I |
| | Anderson | 2 | NC |
| | Circle | 7 | NC |
| Spring 1980 | | | |
| | Mudbight, Hollis, Wrangell | 5 | SE |
| | Kupreanoff | 1, 2, 5, 6 | SE |
| | Gustavas | 3, 7 | SE |
| | Haines | 3, 5, 7 | SE |
| | Valdez | 5 | I |
| | Willow Creek, Jack | 7 | I |
| | Tazlina | 1, 3, 5, 7 | I |
| | Glennallen | 3 | I |
| | Greeley, Tok | 3, 7 | I |
| | Alexander Creek | 6, 8 | SC |
| | Susitna | 4, 8 | SC |
| | Meadow Lakes | 7 | SC |
| | Skwentna | 6 | SC |
| | Montana Creek | 4 | SC |
| | Swan Lake | 5 | SC |
| | Anderson | 4, 8 | NC |
| | Lake Minchumina | 6 | NC |
| | Alder Creek, June Creek, Goldstream, Panquinque Creek, Thendy Hills, Circle, Fairbanks | 3, 7 | NE |

*SE = Southeast
NC = Northcentral
SC = Southcentral
I = Interior

Fall 1980

| | | |
|---|---|---|
| Willow Creek, Tok | 3, 7 | I |
| Glennallen, Warren | 3 | I |
| Tower Bluffs | 7 | I |
| Montana Creek | 3 | SC |
| Circle | 7 | NC |
| Anderson | 3 | NC |

Homesites

Fall 1979

| | | |
|---|---|---|
| Willow Creek, Glennallen | 7 | I |
| Delta | 7, 8 | I |

Spring 1980

| | | |
|---|---|---|
| Mudbight, Hollis, Skagway | 5 | SE |
| Kupreanof | 5, 6, 7 | SE |
| Haines | 6 | SE |
| Valdez, Tower Bluffs, Willow Creek, Glennallen, Greeley, Jack, Delta, Tok | 7 | I |
| Tazlena | 5 | I |
| Goldstreak, Swan Lake, Greensward Lake | 7 | SC |
| Bruce Lake | 5, 7 | SC |
| Skwentna | 6 | SC |
| Bartlett Hills | 8 | SC |
| Panquinque Creek, Goldstream, June Creek, Circle | 7 | NC |

Fall 1980

| | | |
|---|---|---|
| Willow Creek, Glennallen, Tower Bluffs | 7 | I |
| Glennallen | 6, 8 | I |

Remote Sites

Fall 1979

| | | |
|---|---|---|
| Homer | 4 | SC |
| Lake Creek, Hewitt Lake | 2 | SC |
| Northeast Ak. Range, Rock Creek | 2 | NC |
| Windy Creek, Bear Creek | 1 | NC |
| Chena South | 4 | NC |

| | | | |
|---|---|---|---|
| Spring 1980 | | | |
| | Yentna | 2 | SC |
| | Chase | 2, 4 | SC |
| Fall 1980 | | | |
| | Bald Mountain | 4 | SC |
| | Coal Creek, Indian River, Kahlitna, Shell Hills, Yenlo Hills | 2 | SC |
| | Nine Mile | 3 | SC |
| | Robertson River | 2 | I |
| | Kontishna River, Fortuna Creek, Tanana River | 2 | NC |
| | Kokono Creek, Washington Creek, Slate Creek, Left Fork, Crooked Creek | 1 | NC |
| | Hunts Creek | 3 | NC |
| | Anaionda Creek | 4 | NC |

# APPENDIX C

Table C-1 shows the effect of increased distance from Anchorage on the per capita demand for six types of subdivision land. These per capita demand estimates are based on the parameters developed from the Spring 1980 sale and adjusted using the model parameters. This method can be used to assess the effect of changes in the distance to any particular land type on demand.

The changes shown in Table C-1 ignore substitute effects. As mentioned, the equations estimated above do not allow estimation of the effects on the demand for other land types of an increase in the distance to any particular type of land. One method of estimating the substitute effect may be similar to that used in the Southeast case addressed in the paper. If all land types are ranked, we might expect that the population which refrains from buying one type of land as distance increases would buy the next best alternative at a closer distance. The share of population switching could be measured by adjusting for the effect of changes in quality and distance.

TABLE C-1. THE EFFECT OF CHANGES IN DISTANCE ON THE ANCHORAGE PER CAPITA DEMAND FOR LAND TYPES

(Applicants per 1,000 Population)

| | Distance (miles) | | | | | | |
|---|---|---|---|---|---|---|---|
| Land Type | 50 | 75 | 100 | 125 | 175 | 200 | 300 |
| 3 | 2.41 | 1.85 | 1.54 | 1.33 | 1.07 | .98 | .75 |
| 4 | 3.35 | 2.07 | 1.72 | 1.49 | 1.20 | .74 | .57 |
| 5 | 7.42 | 5.34 | 4.23 | 3.53 | 2.68 | 2.41 | 1.73 |
| 6 | 7.88 | 5.67 | 4.49 | 3.74 | 2.85 | 2.55 | 1.84 |
| 7 | 8.05 | 5.79 | 4.58 | 3.82 | 2.91 | 2.61 | 1.88 |
| 8 | 1.76 | 1.27 | 1.00 | .84 | .64 | .57 | .41 |

Note: Underlined values are per capita demand from Spring 1980 sale for each land type.

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November 30, 1982

Lynn Hutton
Office of Information Systems
Pouch H-01G
Dept. of Health and Social Services
Juneau, Alaska 99811

Dear Lynn:

I am pleased to enclose the tabulated results of the 1982 Vietnam Veteran survey. I have included a printout of both weighted and unweighted results. This letter is intended as a brief summary of the survey findings and recommendations concerning the appropriate use of the data.

The Number of Vietnam Veterans in Alaska

In a random sample of 798 households, we found 49 Vietnam veterans. The correctly weighted estimate of the proportion of Vietnam veterans in the Alaskan adult population (excluding adults living on military bases and in group quarters) is 0.033. According to 1980 U.S. census figures, the number of Alaskan adults (using the above definition) is 240,194. Our best estimate, then, of the number of Alaskan Vietnam veterans is 7,993. The survey estimate of 0.033 is subject to an estimated sampling error at the 95 percent confidence level of $\pm$0.012. Therefore, the true number of Vietnam veterans may be as much as 10,832 or as little as 5,156.

The 1980 U.S. census long form responses produced an estimate of 24,441 Vietnam era veterans living in Alaska, but not on military bases. We cannot determine from the census the proportion of Vietnam era veterans who are Vietnam veterans. Using the national figure of 48 percent produced by the Harris survey, however, the estimated number of Vietnam veterans in Alaska could be as much as 11,374.

Since the estimate of 11,374 is above the maximum estimate produced by our survey (10,832), we conclude that the proportion of Alaskan Vietnam era veterans who served in Southeast Asia is lower than the national figure. At the same time, we believe our survey estimate of 7,993 is likely to be low. Our sample frame did not include households lacking telephones in the Anchorage, Mat-Su, and Kenai Boroughs. We suspect that some Vietnam veterans living in these areas may wish to avoid public contact and may not have telephones. Therefore, we suggest that a prudent estimate of the number of Vietnam veterans currently living in Alaska (but not on military bases or in group quarters) is 10,000.

Characteristics of Vietnam Veterans in Alaska: Reliability of Results

It is important to recognize the difficulty in generating a representative sample of Vietnam veterans in Alaska. The only available method of generating a sample is the method employed in this study: a random sample of all Alaskan households. To produce a sample of a size (and hence, reliability) equal to the national Harris survey sample of 1,176, we would have had to contact a random sample of 19,150 Alaskan households. The cost of such a survey could easily exceed $600,000.

Our sample of 49 Alaskan Vietnam veterans has a maximum estimated sampling error of ±14 percent. This means, for example, that the true proportion of Alaskan Vietnam veterans who were part of a unit which engaged enemy troops in a firefight may vary from the observed proportion of 54 percent by ±14 percent. Therefore, the true value may be as much as 68 percent or as little as 40 percent. The estimated sampling errors associated with different observed proportions associated with the entire sample of 49 are as follows:

| Observed Proportions | Estimated Sampling Error |
|---|---|
| 10 percent or 90 percent | ± 8.4 percent |
| 20 percent or 80 percent | ±11.2 percent |
| 30 percent or 70 percent | ±12.8 percent |
| 40 percent or 60 percent | ±13.7 percent |
| 50 percent | ±14.0 percent |

The reliability of observed proportions for subgroups of Vietnam veterans is considerably lower. For example, the proportion of Vietnam veterans with heavy combat experience who reported having health problems is 25 percent. The estimated sampling error for this figure is ±24.5 percent. We, therefore, advise against the use of subgroup comparisons.

Income, Employment, and Education

Survey results for income, employment status, and education all suggest that Alaskan Vietnam veterans are at least as well off as their Lower 48 counterparts. The more relevant comparison, however, is between Alaskan Vietnam veterans and other Alaskan adults who share the same age, sex, and length of residency characteristics. We will provide these comparable figures from the Behavior Risk Survey results as soon as they become available.

Combat Experience

Table 1 compares the reported combat experiences of Alaskan Vietnam veterans and with the experiences of Vietnam veterans nationally. Despite the small size of the Alaskan sample, the similarity in results is striking. Table 2 presents comparable results for the constructed scale of the degree of combat exposure. Again, the results do not significantly differ, particularly when the moderate combat exposure categories are combined (as they should be, given the small Alaska sample).

Incidence of Problems

The consistency of Alaskan survey results with national data is maintained in a comparison of reported problems since leaving the military (see Table 3). The proportion of Alaskan Vietnam veterans reporting problems in getting an education may be lower than the national proportion. This finding is not surprising given the relatively higher proportion of Alaskan Vietnam veterans who have completed high school (96 percent versus 74 percent). Even this apparent difference is not statistically significant, however.

We believe that the difference in reported discrimination problems may warrant particular attention. We will discuss this finding further below.

The most important conclusions that can be drawn from the survey do not concern the few apparent differences between Vietnam veterans in Alaska and in the United States as a whole. Rather we think it is evident that many Alaskan Vietnam veterans, along with other U.S. Vietnam veterans, have experienced a variety of specific problems since leaving the military. Veterans who have experienced specific problems appear in Table 4. The estimates are based on a population estimate of 10,000.

The figures appearing in Table 4 can be misleading. First, our survey was restricted to Vietnam veterans. We estimate that there may be another 14,000 Vietnam era veterans living in Alaska. The Harris survey results indicate that, nationally, Vietnam era veterans who did not serve in Southeast Asia nevertheless experienced

significant problems (see Table 5). If we apply these national figures to the estimated Alaskan population of 14,000, we increase the size of the veteran populations which have experienced most specific problems.

At the same time, we must also consider the fact that veterans who have experienced problems in the past may not be experiencing the same problems currently. Our survey included questions on the current incidence of problems (see Table 6). The results suggest that the current incidence of problems is significantly less than the past incidence of problems, particularly with regard to discrimination, locating a job, and drug or alcohol abuse.

We believe an adequate summary of the incidence of problems among Vietnam veterans in Alaska should include Vietnam era veterans who did not serve in Southeast Asia and should reflect changes in the incidence of problems over time. Therefore, we have prepared a range of estimates in Table 7. The estimate in the left-hand column of Table 7 represents a maximum estimate of the number of Vietnam era veterans in Alaska who may experience each specific problem covered by the survey. This assumes that veterans reporting past problems may again experience them. The estimate is derived by adding the numbers which appeared in Table 4 to a comparable set of numbers for non-theater veterans based on a base population estimate of 14,000 and national incidence figures.

The second column from the left in Table 7 repeats the numbers from Table 4; thus, it pertains only to Vietnam veterans. The third column from the left applies the proportions of Alaskan Vietnam veterans reporting current problems to the entire estimated Vietnam era veteran population. Finally, the right column of Table 7 indicates our estimates of the number of Alaska Vietnam veterans currently experiencing each type of problem.

Sincerely,

John A. Kruse

John A. Kruse
Assoc. Professor of Survey Research

TABLE 1
COMBAT EXPERIENCE

| | Percentages Having Experience | |
|---|---|---|
| | Alaskan Veterans | U.S. Veterans |
| 1. You were part of a land or naval artillery unit which fired on the enemy | 42% | 46% |
| 2. Flew in aircraft over South or North Vietnam | 63% | 44% |
| 3. Stationed at a forward observation post | 38% | 37% |
| 4. Received incoming fire from enemy artillery, rockets, or mortars | 81% | 76% |
| 5. Unit patrol encountered mines and booby traps | 46% | 42% |
| 6. Unit received sniper or sapper fire | 76% | 66% |
| 7. Unit patrol was ambushed | 40% | 33% |
| 8. Unit patrol engaged in Vietcong, guerrilla troops, or the North Vietnam army in a firefight | 54% | 48% |
| 9. Saw either Americans or Vietnamese killed or wounded in Vietnam | 77% | 73% |
| 10. Suffered war-related wounds in Vietnam | 13% | 23% |
| Number of respondents: | 49 | 1,176 |

TABLE 2
DEGREE OF COMBAT EXPOSURE

| | Alaskan Veterans | U.S. Veterans |
|---|---|---|
| Harris Index of Combat Exposure | | |
| Light combat exposure | 41 | 30 |
| Moderate passive combat exposure | 9 | 28 |
| Moderate active combat exposure | 26 | 10 |
| Heavy combat exposure | 24 | 31 |
| | 100% | 100% |
| Number of respondents | 49 | 1,176 |

TABLE 3
PROBLEMS OF VIETNAM VETERANS

Question: "Which, if any, of the following problems experienced by some other Vietnam era veterans have you experienced since leaving the military?"

| | Percentages Having Experience | |
|---|---|---|
| | Alaskan Veterans | U.S. Veterans |
| 1. Problem getting a job | 22% | 30% |
| 2. Problem getting an education | 10% | 24% |
| 3. Problems with drugs or drinking too much | 19% | 19% |
| 4. Mental or emotional problems | 30% | 21% |
| 5. Health problems | 18% | 21% |
| 6. Not knowing what you want out of life | 32% | 27% |
| 7. Being frightened by memories of death and dying | 31% | 22% |
| 8. Being discriminated against because you were in the Armed Forces when the war was going on | 29% | 16% |
| 9. Family problems with spouse or children | 19% | 17% |
| 10. Being in and out of trouble with the law | 7% | 5% |
| Number of respondents | 49 | 1,176 |

SOURCES: ISER Survey (1982), Harris Survey (1979).

TABLE 4

ESTIMATED NUMBERS OF ALASKAN VIETNAM VETERANS EXPERIENCING SPECIFIC PROBLEMS SINCE LEAVING THE MILITARY[1]

| | | Estimated Number of Alaskan Vietnam Veterans Experiencing Problem Since Leaving Military (rounded to nearest 100) |
|---|---|---|
| 1. | Not knowing what you want out of life | 3,200 |
| 2. | Being frightened by memories of death and dying | 3,100 |
| 3. | Mental or emotional problems | 3,000 |
| 4. | Being discriminated against because you were in the Armed Forces when the war was going on | 2,900 |
| 5. | Problem getting a job | 2,200 |
| 6. | Family problems with spouse or children | 1,900 |
| 7. | Problems with drugs or drinking too much | 1,900 |
| 8. | Health problems | 1,800 |
| 9. | Problem getting an education | 1,000 |
| 10. | Being in and out of trouble with the law | 700 |

[1]Based on an estimated total population of Vietnam veterans of 10,000.

TABLE 5
PERCENTAGES OF U.S. VIETNAM ERA VETERANS NOT SERVING IN SOUTHEAST ASIA WHO REPORTED EXPERIENCING SPECIFIC PROBLEMS

| | | Percentage[1] |
|---|---|---|
| 1. | Not knowing what you want out of life | 25% |
| 2. | Being frightened by memories of death and dying | 5% |
| 3. | Mental or emotional problems | 13% |
| 4. | Being discriminated against because you were in the Armed Forces when the war was going on | 10% |
| 5. | Problem getting a job | 26% |
| 6. | Family problems with spouse or children | 11% |
| 7. | Problems with drugs or drinking too much | 13% |
| 8. | Health problems | 13% |
| 9. | Problem getting an education | 24% |
| 10. | Being in and out of trouble with the law | 3% |
| Number of Respondents: | | 1,281 |

[1]Calculated from the Harris results reported in Table V-5, pp. 116-119.

TABLE 6
COMPARISON OF PAST AND CURRENT EXPERIENCE WITH
SPECIFIC PROBLEMS AMONG ALASKAN VIETNAM VETERANS

| | Past Experience | Current Experience |
|---|---|---|
| 1. Not knowing what you want out of life | 32% | 18% |
| 2. Being frightened by memories of death and dying | 31% | 16% |
| 3. Mental or emotional problems | 30% | 19% |
| 4. Being discriminated against because you were in the Armed Forces when the war was going on | 29% | 4% |
| 5. Problem getting a job | 22% | 5% |
| 6. Family problems with spouse or children | 19% | 9% |
| 7. Problems with drugs or drinking too much | 19% | 3% |
| 8. Health problems | 18% | 14% |
| 9. Problem getting an education | 10% | 4% |
| 10. Being in and out of trouble with the law | 7% | 6% |
| Number of Respondents: | 49 | 49 |

TABLE 7
ALTERNATIVE ESTIMATES OF PROBLEM INCIDENCE IN ALASKA

| | Vietnam Era Vet Past Incidence | Vietnam Vet Past Incidence | Vietnam Era Vet Current Incidence | Vietnam Vet Current Incidence |
|---|---|---|---|---|
| 1. Not knowing what you want out of life | 6,700 | 3,200 | 4,300 | 1,800 |
| 2. Being frightened by memories of death and dying | 3,800 | 3,100 | 3,800 | 1,600 |
| 3. Mental or emotional problems | 4,800 | 3,000 | 4,600 | 1,900 |
| 4. Being discriminated against because you were in the Armed Forces when the war was going on | 4,300 | 2,900 | 1,000 | 400 |
| 5. Problem getting a job | 5,800 | 2,200 | 1,200 | 500 |
| 6. Family problems with spouse or children | 3,400 | 1,900 | 2,200 | 900 |
| 7. Problems with drugs or drinking too much | 3,700 | 1,900 | 700 | 300 |
| 8. Health problems | 3,600 | 1,800 | 3,400 | 1,400 |
| 9. Problem getting an education | 4,400 | 1,000 | 1,000 | 400 |
| 10. Being in and out of trouble with the law | 1,100 | 700 | 1,400 | 600 |

OFFICE USE ONLY

# VIETNAM ERA VETERAN SURVEY
# QUESTIONNAIRE

| STATE OF ALASKA<br>DEPT. OF HEALTH AND SOCIAL SERVICES | INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH |
|---|---|

The Alaska State Legislature is studying the needs of Alaskans who served in the armed forces in Southeast Asia sometime during the period from August 1964 to June 1975. Information collected from this survey will be used by the state to identify the need for special programs in the areas of employment, health, and education to benefit Alaskan Vietnam veterans. Your participation in this survey is voluntary, but very important. Your answers will remain strictly confidential and will only be used in combination with the answers of other Alaskan Vietnam veterans.

Please mark the number corresponding to your response in the box to the right of each question.

A.1. When were you in the Armed Forces?

| | MONTH | YEAR |
|---|---|---|
| FROM | | |
| TO | | |

A.2. What branch of the service were you in?

1. ARMY
2. MARINES
3. NAVY
4. AIR FORCE
5. OTHER _____
9. NA

A.2. ☐

A.3. Which, if any, of the following problems experienced by some other Vietnam era veterans have you experienced since leaving the military? For each problem you have experienced, please answer questions A.4. and A.5.

A.4. How often have you had this problem: rarely, sometimes, often or very often?

A.5. Is this a problem for you now?

| TYPE OF PROBLEM | A.3. 1.YES 2.NO | A.4. 1.RARELY 2.SOMETIMES 3.OFTEN 4.VERY OFTEN | A.5. 1.YES 2.NO |
|---|---|---|---|
| a. Problem getting a job? | ☐ | ☐ | ☐ |
| b. Problem getting an education? | ☐ | ☐ | ☐ |
| c. Problems with drugs or drinking too much? | ☐ | ☐ | ☐ |
| d. Mental or emotional problems? | ☐ | ☐ | ☐ |
| e. Problems with your health? | ☐ | ☐ | ☐ |
| f. Not know what you want out of life? | ☐ | ☐ | ☐ |
| g. Being frightened by memories of death and dying? | ☐ | ☐ | ☐ |
| h. Being discriminated against because you were in the Armed Forces when the war was going on? | ☐ | ☐ | ☐ |
| i. Family problems with spouse or children? | ☐ | ☐ | ☐ |
| j. Being in and out of trouble with the law? | ☐ | ☐ | ☐ |

A.6. Following is a list of experiences you may have had in Southeast Asia. For each one, please mark 1 in the box for yes if you had this experience, or 2 for no if you didn't.

| | 1. YES<br>2. NO |
|---|---|
| A.6a. You were part of a land or naval artillery unit which fired on the enemy..... | ☐ |
| A.6b. Flew in aircraft over South or North Vietnam..... | ☐ |
| A.6c. Stationed at a forward observation post..... | ☐ |
| A.6d. Received incoming fire from enemy artillery, rockets, or mortars..... | ☐ |
| A.6e. Unit patrol encountered mines and booby traps..... | ☐ |
| A.6f. Unit received sniper or sapper fire..... | ☐ |
| A.6g. Unit patrol was ambushed..... | ☐ |
| A.6h. Unit patrol engaged in Vietcong, guerrilla troops, or the North Vietnam army in a firefight..... | ☐ |

A.7. Thinking of all the combat experiences you had in Southeast Asia, would you say that you experienced one or more of them rarely, sometimes, often, or very often while you were there?

1. RARELY
2. SOMETIMES
3. OFTEN
4. VERY OFTEN

A.7. ☐

A.8. Did you see either Americans or Vietnamese killed or wounded in Vietnam?

1. YES
2. NO

A.8. ☐

A.9. Did you suffer any war-related wounds in Vietnam?

1. YES
2. NO

A.9. ☐

A.10. Are you currently employed?

SKIP TO Q. A.12. ← 1. YES

2. NO

A.10. ☐

A.11. Do you want a job or have you decided not to work at this time?

SKIP TO Q. A.14. ← 1. WANT A JOB
2. DECIDED NOT TO WORK

A.11. ☐

A.12. Are you working full-time (35 hours a week or more) or part-time?

SKIP TO Q. A.14 ← 1. FULL-TIME

2. PART-TIME

A.12. ☐

A.13. Do you want to work part-time or full-time?

1. PART-TIME
2. FULL-TIME

A.13. ☐

A.14. For 1981, was your income before taxes greater than or less than $20,000?

1. GREATER THAN $20,000
2. LESS THAN $20,000

A.14. ☐

A.14a. If your 1981 income before taxes was less than $20,000, was it greater or less than $10,000?

1. GREATER THAN $10,000
2. LESS THAN $10,000

A.14a. ☐

A.14b. If your 1981 income before taxes was greater than $20,000, was it greater or less than $30,000?

1. GREATER THAN $30,000
2. LESS THAN $30,000

A.14b. ☐

A.15. What is your race or ethnic origin?

1. WHITE
2. AK NATIVE (INDIAN, ESKIMO, ALEUT)
3. BLACK
4. ASIAN OR PACIFIC ISLANDER
5. HISPANIC
7. OTHER _____

A.15. ☐

A.16. What is the last grade of school or year of college you have completed?

A.16. ☐

A.17. How many years have you lived in Alaska?

A.17. ☐

This concludes the questionnaire. Thank you for your assistance. If you have additional comments, please feel free to use the back of the questionnaire. If you have any questions regarding the survey, call either Jack Kruse or Elsa Aegerter at 278-4621.