

**Methods for Rural / Non-Rural
Determinations for Federal
Subsistence Management
in Alaska**

Summary Report

Analysis and Recommended Methodology

Submitted to:

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Introduction

Determining which Alaska communities are rural and which are non-rural is a critical element of the federal subsistence management program. This project, *Methods for Rural/Non-Rural Determinations for Federal Subsistence Management in Alaska*, is a step in developing a standard methodology for the Federal Subsistence Board to employ in making such determinations. The analyses and recommendations of the report are designed to facilitate clear, unambiguous, and consistent decisions.

This summary presents the major findings of the project. A complete presentation of findings is contained in the Final Report, including a literature review, focus group contributions, criteria development, methodologies, tests of methodologies, and references.¹ The project also produced a database containing variables examined in the project for case populations.

Two methodologies were identified as most effective to classify rural and non-rural areas. One methodology, called *Discriminant Analysis Assessment*, is an approach using inductive, multivariate statistical modeling. The other methodology, called *Criterion-Referenced Assessment*, is an approach that uses simple logic and deduction in applying rural/non-rural standards. Each methodology applies measures drawn from the federal decennial census and the State of Alaska's harvest records, among other relevant data sources. In developing methodologies, an overriding goal was to use a minimal number of criteria that clearly, effectively, and defensibly distinguish between rural and non-rural populations in Alaska.

A review of over two hundred variables found two primary criteria suitable to distinguish among Alaska rural and non-rural populations – *population density* and *country food production*, what we in Alaska usually call wild food harvesting. For a relatively small number of populations not clearly classified with the two primary criteria, additional variables can be used in a case method assessment.

Our tests of methodologies should not be construed as actual determinations of rural and non-rural status. The analyses were performed to determine whether the concepts developed in the study would work in real world application. Implementation of the recommended methodology requires a number of additional steps outlined in the report.

The recommended methodology does not preempt any Federal Subsistence Board prerogatives. Rather, it is intended to facilitate rural status determinations by the Board. It clarifies the categorization of most areas and focuses on the process of final decision making with respect to remaining communities. Final determinations are thus clearly subject to Board decisions.

The analysis and recommendations in this report are those of the authors and do not necessarily reflect the views of the U.S. Fish and Wildlife Service, Office of Subsistence Management, or the Federal Subsistence Board.

¹ <http://www.iser.uaa.alaska.edu/Home/ResearchAreas/OtherRuralStudies.htm>

Rural Concepts

Methodologies for classifying rural and non-rural areas for subsistence management cannot diverge too far from common meanings of the term “rural.” Evaluation criteria need to be firmly grounded in credible construction of terms consistent with common meanings and the scientific literature.

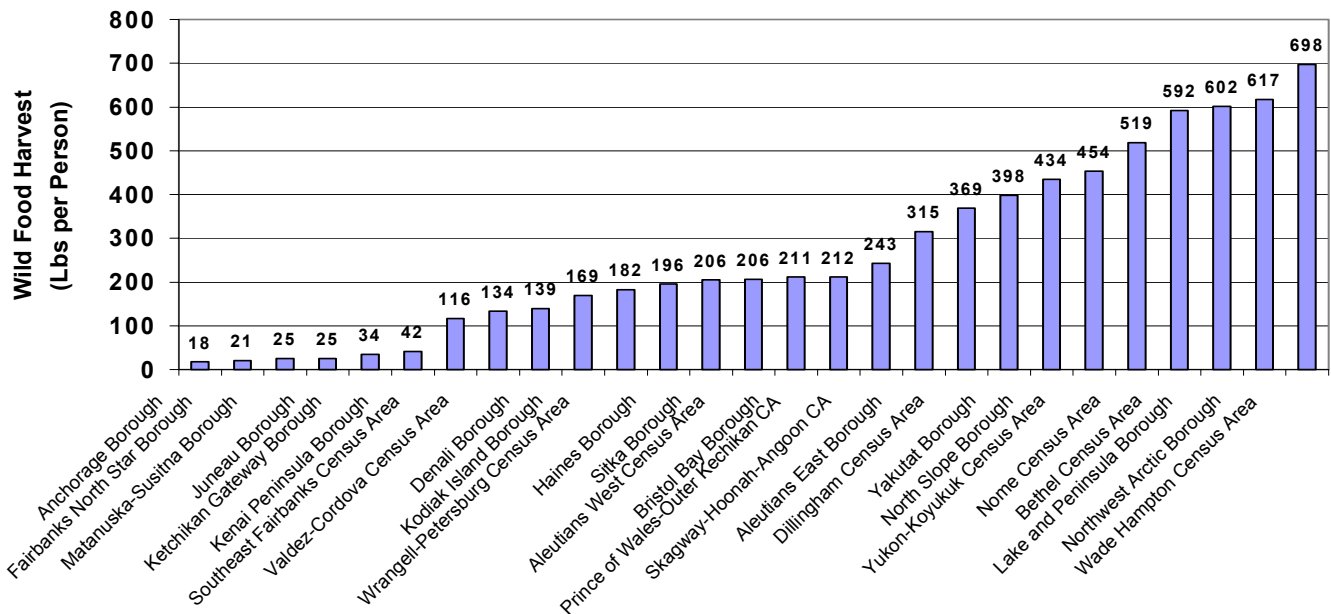
Under accepted general concepts, a population regularly supported by extensive land uses (such as country food production, commercial fishing, forestry, and so forth) within a sparsely-populated, open country is “rural.” That is, *extensive land use* and *sparsely-populated, open country* are each a primary mark of being rural. A population not supported by extensive land uses within a relatively densely-populated area is “non-rural,” failing two of the primary features. Populations displaying a mix of features are of less certain classification and need additional assessment.

In addition, under the general concepts, one would expect a rural population to display certain distinctive patterns of knowledge, belief, experience, skills, value orientations, and customs connected to country living. Through regular daily interaction with the open land and its ways of living, rural people come to be distinguishable from city people.

Our methodologies treat the first two general characteristics (*extensive land uses* and *sparsely-populated, open country*) as *primary* concepts for identifying rural populations in Alaska. They are each central to the most common meanings of “rural,” and they each have measures generally available in demographic and other scientific databases. Most Alaska populations can be identified as “rural” or “urban” using the two primary concepts. Measures related to the third general characteristic (*distinctive cultural patterns connected to country living*) are treated as *ancillary* evidence in support of classifications made with the two *primary* concepts. Information is not consistently available for ancillary factors. However, ancillary concepts may be useful as additional information for assessing particular cases, especially those not clearly identified with primary factors.

In Alaska, non-commercial fishing and hunting for local consumption is a primary activity in rural areas. Wild food harvest levels vary substantially by region, as illustrated by Fig. 1, with the lowest per capita harvests found in Alaska’s large, populated census areas.

**Fig. 1. Wild Food Harvests
(Lbs Per Person per Year)
by Residents of Alaska Census Areas**



For producing wild foods, a *central-based use area* pattern is a common land use pattern in rural Alaska. In regions off the Alaska road system, settlements are typically compact, with residences, services, businesses, schools, and airports occupying a central area. The surrounding commons are relatively open, with low human populations, and containing modest infrastructures such as trail systems, fishing camps, trapping cabins, and so forth. A core use area surrounding a rural settlement generally supports most wild food harvest. Larger use areas extending beyond the intensively-used core are used more occasionally. Use areas of rural settlements commonly overlap those of other rural settlements at the margins.

“Low density,” a primary rural characteristic, is a reflection of such rural land use patterns in Alaska. While the central settlement is compact and densely populated, the surrounding areas regularly used for wild food production is sparsely-populated, open country, being relatively empty of residences or other built structures.

A *metropolitan land* use pattern characterizes Alaska’s largest, non-rural settlements, including Anchorage, Fairbanks, and the Palmer-Wasilla area. The populations of these cities are commonly dispersed along road-connected areas, rather than centralized in a single, compact location. The road-connected area is used on a daily basis for employment, commerce, schooling, and so forth. In a metropolitan land use pattern, non-rural residents make use of surrounding commons, especially for periodic recreational outdoor activities, including boating, hiking, camping, sport fishing, and hunting.

Focus Groups and Rural Concepts

Eight focus groups were convened as part of our project to help identify rural and non-rural concepts. Focus groups are interviews of a small number of participants about a common topic or experience.

Focus groups were held in seven Alaska communities – Copper Center, Deering, Fairbanks, Kenai (two sessions), Ketchikan, Kotzebue, and Saxman. The places were selected to represent geographic and community diversity in Alaska. We scheduled two focus groups at Kenai, one with members from the greater Kenai community and one with members from the Kenaitze tribe, located in the Kenai area.

Participants invited to the focus groups were chosen to encompass a range of views representative of their communities. A minimum of five years of residency in Alaska was a requirement for participation. In addition, members of the area's federal subsistence Regional Advisory Council (RAC) were invited to each focus group.

Rural/non-rural concepts provided by the focus groups followed three general themes.

First, rural communities were thought to display closer relationships between family and neighbors compared with urban areas, by virtue of their smaller sizes and closer family ties. The personal, close-knit character of rural communities included more community-wide activities (such as ceremonies) and greater assistance between neighbors (such as sharing wild foods) compared with non-rural areas.

Second, rural communities were thought to be more dependent on the natural environment for food and daily activities compared with urban areas. Some participants characterized wild food harvests as “self-sufficiency,” while others viewed the harvests as carrying out long-term customs and traditions within a larger group dependent on wild foods.

Third, residents of rural communities were thought to have less access to services, reasonably priced commercial goods, and employment opportunities compared with residents of urban areas. Rural areas commonly displayed a patchwork infrastructure for water delivery, sewage disposal, electricity, and other services. These themes were offered in each of the focus groups, indicating that the rural concepts were generally held across regions and community types in Alaska.

Rural Measures

A central purpose of this project was to identify factors for distinguishing rural and non-rural populations in Alaska. An overriding goal was to use a minimal number of criteria that can clearly, effectively, and defensibly distinguish between rural and non-rural

populations. Building on the general rural concepts described above, two measures of primary rural concepts were developed for use in identifying rural/non-rural populations – *Country Food Production* and *Density of People in a Standard Daily Use Area*. The measures for these primary concepts were developed specifically for the project using federal census and Alaska harvest data sources.

Country Food Production is a measure of the primary rural concept, *extensive land use*. This is a measure of the quantities of country foods harvested for local consumption within a population. Harvests within a population are converted to standard weights (usable lbs), summed, and divided by the population size. Harvests are expressed in terms of lbs and their nutritional content (percentage of the Recommended Dietary Allowance for protein). A log transformation of the index is used in certain statistical analyses.

There are two information sources for measuring *country food production*. The Community Profile Database (CPDB) of the Alaska Department of Fish and Game (ADF&G) provides household survey information for surveyed Alaska communities. The Harvest Ticket/Permit Records of ADF&G provide harvest information from non-commercial net fisheries, hook-and-line fisheries, and hunts of large land mammals that require a permit or license.

Density of People in a Standard Daily Use Area is a measure of the primary rural concept, *sparsely-populated, open country*. This is a measure of the numbers of people living within a standard area surrounding a case population, weighted by distance from the origin population. In our study, the variable was assessed using three distances – 10 miles, 20 miles, and 30 miles. The 30-mile distance, representing a generous daily commute distance, was chosen as the standard because it performed best in the statistical models. The 2000 United States census is the source for information on population sizes and geographic locations of census unit populations.

In the approach we are taking, the basic unit of analysis is a “population.” A population is defined as a set of people identified by geographic or community boundaries. The general rule of aggregation/disaggregation for initial assessment is that any identifiable population may be legitimately assessed for “rural” or “non-rural” designation, subject to availability of information.

In our tests of methodologies, 195 case populations were examined. For populations off Alaska’s road system, case populations were identified by linking information at the level of community, census designated place, and municipality. For off-road areas, there usually is a fairly direct correspondence between community in ADF&G databases and census designated place or municipality in the federal census. Therefore, linking measures for these case populations from databases was fairly straightforward.

For populations along Alaska’s road system, the linking of measures to populations requires more complex procedures. Our analysis identified population groupings that provided fine resolution and valid measurement of key rural/non-rural factors (density

variables and harvest variables) along road systems. To achieve this goal, information was linked through census tracts, tract groupings, census designated places, and community of residence. The details of this linkage and a discussion of some co-residence issues are provided in the full report.

Methodologies for Identifying Rural and Non-Rural Populations

Two alternative methodologies for determining the rural and non-rural character of Alaska populations were developed during this project. The two alternative methodologies are called *Discriminant Analysis Assessment* and *Criterion-Referenced Assessment*. Each approach is described in detail in the full report, including the application of each methodology to a test set of 195 case populations.

Methodology 1. Discriminant Analysis Assessment

Discriminant analysis (also called *discriminant function analysis*) is a statistical method designed to distinguish between one or more groups. It is a type of multivariate modeling that relies on correlation and multiple regression of variables measured with interval data (or near interval data).

Using discriminant analysis, variables are identified that distinguish between groups of cases (the groups are called the *dependents*). The variables found to statistically distinguish between groups are called *discriminating variables* (also called *predictors* or *independents*). The discriminating variables are statistically combined into numeric equations called *discriminant functions* (also called *canonical roots*). A discriminant function can be treated as a *criterion* for distinguishing among groups.

The discriminant functions can be used to classify uncertain cases into the groups of cases. For case populations, discriminating variables are measured and the values entered into the numeric equations (the discriminant functions). The case population's score indicates its group. The case is classified with the group to which its numeric value is closest to the numeric *centroid* of each group. The nearness of the case population's score to the group's centroid indicates the clarity or ambiguity of the classification.

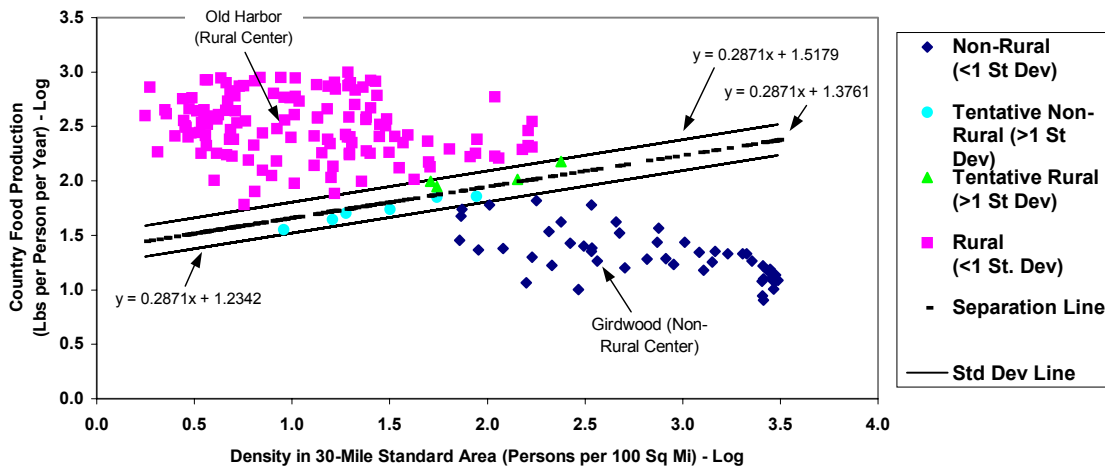
Discriminant analysis was conducted with a selection of Alaska populations comprising the set of cases, while the dependents (groups) were "rural" or "non-rural." In this test of the methodology, case populations were included in the analysis if they had greater than 49 people, country food harvests of less than 1,000 lbs per capita, and data was available on discriminating variables. There were 195 populations meeting the selection criteria in the data set. The selection was done to reduce the number of potential case outliers (cases with very small or large values), which can confound statistical correlations. Very small populations (<50 people) are likely to be classed as "rural" under most standards and may display unusual traits linked to their size. Populations with exceptionally large annual productions of country foods (such as those with harvests greater than 1,000 lbs per year) also are likely to be classed as "rural," regardless of any other characteristic they may display.

Fourteen separate discriminant function analyses were conducted with discriminating variables to test the methodology. Each analysis was conducted with slightly different starting conditions, variable measurements, or case population definitions. A discussion of the fourteen analyses is presented in the Final Report. In this summary, the “best analysis” from these fourteen runs is presented. This best analysis discriminated the greatest amount of the variability among case values, as measured by the *canonical correlation*. The model discriminated 82.3% of the variability in the two discriminating variables among the 195 case populations, which is a very high value (a canonical correlation of .907).

The statistical relationship between country food production and density for the 195 case populations is shown here in Fig. 15, which is one of many illustrations in the Final Report. The scatter plot illustrates a cluster of case populations toward the upper left (rural) and a cluster toward the lower right (non-rural) with a noticeable separation. It clearly demonstrates that relatively lower levels of country food production occur in higher density populations, while relatively higher levels of country food production occur in lower density populations.

In this two-variable model, the threshold separating cases is represented as a line, as illustrated in Fig. 15. The line is defined by combinations of values of the two variables corresponding to the midpoint between group centroids. Cases to the left side of the line are closer to the “rural” group, while cases to the right side are closer to the “non-rural” group. In Fig. 15, the distances representing one standard deviation from each group’s center are also depicted as lines. Cases with scores falling within this area of the graph (greater than one standard deviation) received tentative rural or non-rural classifications, following the above classification rules.

Fig. 15. Alaska Populations (N = 195) Categorized into Rural or Non-Rural Groups by two Primary Factors (Density and Country Food Production), With Threshold Lines at One Standard Deviation from Each Group Center



Using the discriminant analysis, we calculated a *discriminant function*, which is a latent variable (statistically-constructed variable) created as a linear combination of discriminating variables, taking the form of an equation $L = b_1x_1 + b_2x_2 + \dots + b_nx_n + c$. In this equation, the *b*'s are *discriminant coefficients*, the *x*'s represent the values of discriminating variables, and *c* is some constant number. In our best analysis, the discriminant function equation is $L = 2.828(LGPCAP3) - .812(LGDEN30) - 4.882$. By entering the values of the two variables for each case population into this equation, each case population's score on the discriminant function was calculated.

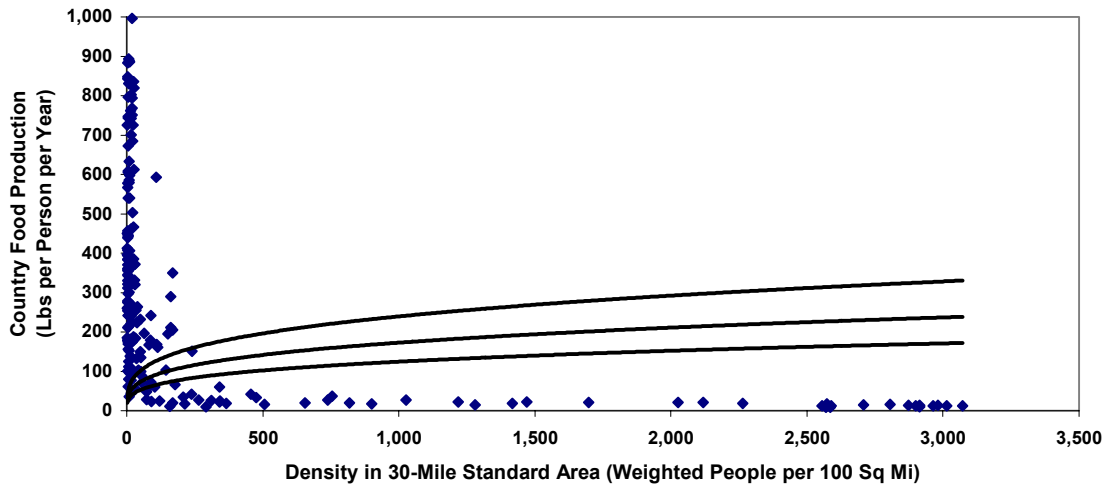
Results are shown in the Final Report table, *Outcome Scores and Classifications from Discriminant Analysis Assessment*. The classifications in this table are made with the following rules: cases with scores closer than one standard deviation from a group's centroid are classified into that group; cases with scores greater than one standard deviation from a group centroid are *tentatively classified* in the group with the closest centroid.

Using these rules to assess the 195 case populations, 185 cases (95%) were categorized with a fair degree of certainty, defined as case scores closer than one standard deviation from the center of each group. Of these, 134 cases were categorized as "rural" and 51 cases were categorized as "non-rural." Ten case populations were given tentative classifications, defined as having scores greater than one standard deviation from the center of each group. Of the tentative cases, four were tentatively classified as "rural" and six were tentatively classified as "non-rural," representing the group to which its score was closest.

A second assessment step can be taken for reviewing the classification of tentative cases, using a set of *ancillary variables* (such as other extensive land uses, specialized production, and other rural factors), drawn from existing data sets, case method materials, public comment, and additional data collection. Examples of ancillary variables are provided in the next section on *Criterion-Referenced Assessment*.

The actual dispersion of case populations in relation to the general classification model is shown as Fig. 17. The scatter of cases clearly reflects the bifurcated character of Alaska populations. Most of the chart (where cases might appear) is empty. Case populations appear either scattered along the y-axis (lower densities and substantial country food harvests) or along the x-axis (higher densities and insubstantial country food harvests). Ambiguous cases are relatively few, located in the interstices of the threshold lines. The ability of the discriminant function model to successfully separate cases into rural and non-rural groups results from the basic bifurcation of Alaska populations along the two measures.

Fig. 17. Relationship of Density and Country Food Production in 195 Alaska Populations, and General Classification Model



Methodology 2. Criterion-Referenced Assessment

Criterion-Referenced Assessment is a general methodology for classifying cases into categories. Criterion-referenced assessments compare cases against absolute standards established as classification thresholds. If a case meets or exceeds standards, it receives one classification. If it falls below standards, it receives a different classification.

Criterion-Referenced Assessment is commonly used in educational testing, where student performances are the cases and grades are classification categories (such as “A”, “B”, *etc.*). Student performance is measured through test questions designed to reflect proficiency levels. The measured performance is compared with standards. Criterion-referenced assessment also is commonly used by government agencies for awarding entitlements and other benefits. Applicants are scored and compared with standards to identify those qualified.

For the classification of “rural residents” and “non-rural residents” in our study, the cases are populations of Alaska residents. In our criterion-referenced assessment, two *primary criteria* and three *ancillary criteria* are identified for distinguishing between rural and non-rural populations. Variables and standards measuring the criteria are defined as the following:

Primary Criterion 1. Country Food Production

Variable: Annual per capita harvest (lbs) of country food.

General Standards:

“Very High (VH)” >115 lbs (>75% RDA for protein)

“Moderately High (MH)” 75-114 lbs (50%-74% RDA for protein)

“Moderately Low (ML)” 40-74 lbs (25%-49% RDA for protein)

“Very Low (VL)” <39 lbs (<24% RDA for protein)

Primary Criterion 2. Sparsely-Populated, Open Country

Variable: Weighted population in a 30-mile standard area.

General Standards:

“Yes (Y)” <100 people/100 sq mi

“No (N)” >100 people/100 sq mi

Ancillary Criterion 3. Other Extensive Land Uses

Variable: Regular employment in commercial fisheries, forestry, etc.

General Standards:

“Yes (Y)”

“No (N)”

Ancillary Criterion 4. Noncommercial Fishery or Hunt Center

Variable: Substantial harvest and distribution of specialty country food products.

General Standards:

“Yes (Y)”

“No (N)”

Ancillary Criterion 5. Preponderance of Other Rural Features

Variables: (a) Diversity of Resources Used; (b) Diversity of Resources Shared; (c) Country-Oriented Knowledge and Values; (d) Geographic Isolation.

General Standards:

“Yes (Y)”

“No (N)”

Using these criteria and variables, the rules for categorizing cases as “rural” or “non-rural” with the standards are presented in the following matrix. The primary criteria are used to make initial classifications. The additional *ancillary criteria* are used, as necessary, for categorizing cases remaining uncertain, (a) in matrix.

**Rules for Classifying "Rural"
and "Non-rural" Populations with Criteria**

		Criterion 2. Sparsely-Populated (Open) Country	
		No	Yes
Criterion 1. Country Food Production	Very Low	"Non-rural"	"Non-rural"
	Moderately Low	"Non-rural"	(a)
	Moderately High	(a)	"Rural"
	Very High	"Rural"	"Rural"

(a) "Non-rural" unless one other rural feature (Criteria 3, 4, 5)

The threshold standards for categorizing cases are designed to result in the following classification outcomes, based on definitions of rural populations and non-rural populations:

Definitions of "Rural" and "Non-Rural" Populations

Rural Populations are populations...

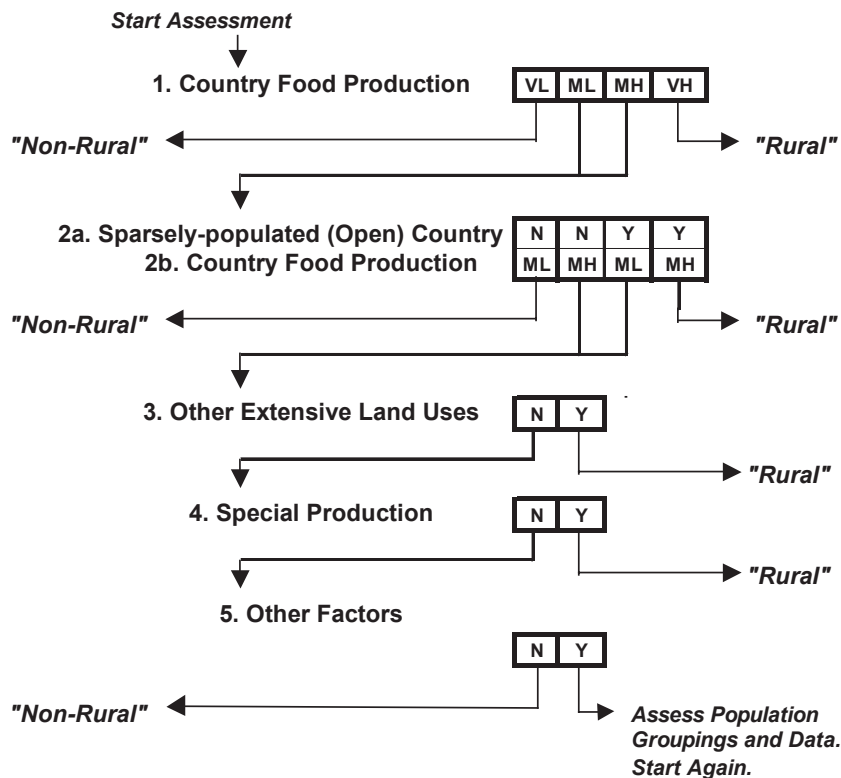
1. with very high production of country foods; or
2. with moderately-high production of country foods and in sparsely-populated (open) country; or
3. with moderately-low production of country foods and in sparsely-populated (open) country, or with moderately-high production of country foods and in other than sparsely-populated (open) country, and having one other rural feature:
 - A. regular employment in extensive land uses, or
 - B. a center for a special or distinctive non-commercial fishery or hunt, or
 - C. a preponderance of other factors of a rural nature, such as diversity of resources used, diversity of resources shared, country-oriented knowledge and values, and geographic isolation.

Non-Rural Populations are populations...

1. with very low production of country foods; or
2. with moderately-low production of country foods and in other than sparsely-populated (open) country; or
3. with moderately-low production of country foods and in sparsely-populated (open) country, or with moderately-high production of country foods and in other than sparsely-populated (open) country, and having no other rural feature:
 - A. no regular employment in extensive land uses, and
 - B. no center for a special or distinctive non-commercial fishery or hunt, and
 - C. no preponderance of other factors of a rural nature, such as diversity of resources used, diversity of resources shared, country-oriented knowledge and values, and geographic isolation.

Case populations are assessed with the criteria following a set procedure (decision tree) and series of questions:

Assessment Procedure (Decision Tree)



Assessment Procedure (Question Series)

1. Is the production of country food "very high," "moderately high," "moderately low," or "very low"?
Measured by the per capita production of country food for local use.
 - a. *very high (>115 lbs) = "Rural"*
 - b. *moderately high (75-114 lbs) = "Uncertain" (continue)*
 - c. *moderately low (40-74 lbs) = "Uncertain" (continue)*
 - d. *very low (< 39 lbs) = "Non-rural"*
- 2a. Is the population in "sparsely-populated (open) country"?
Measured by the weighted population in a 30-mile standard area.

AND
- 2b. Is the production of country food "moderately high" or "moderately low"?
Measured by the per capita production of country food for local use.
 - a. *yes (< 100 people/100 sq mi) and moderately high (75-114 lbs) = "Rural"*
 - b. *yes (< 100 people/100 sq mi) and moderately low (40-75 lbs) = "Uncertain" (continue)*
 - c. *no (> 100 people/100 sq mi) and moderately high (75-114 lbs) = "Uncertain" (continue)*
 - d. *no (> 100 people/100 sq mi) and moderately low (40-75 lbs) = "Non-rural"*
3. Is the population regularly supported by (employed in) extensive land uses, such as commercial fishing or forestry?
 - a. *yes = "Rural"*
 - b. *no = "Uncertain" (continue)*
4. Is the population a center for a special or distinctive noncommercial fishery or hunt for non-local distribution and local use?
 - a. *yes = "Rural"*
 - b. *no = "Uncertain" (continue)*
5. Is there a preponderance of other factors of a rural nature, such as diversity of resources used, diversity of resources shared, country-oriented knowledge and values, and geographic isolation?
 - a. *yes = "Rural"*
 - b. *no = "Uncertain" (continue)*

The criterion-referenced method was applied in the assessment of 195 case populations in Alaska, and the outcomes are fully presented in the table, *Application of Criterion-Referenced Assessment Method* in the Final Report. The case populations comprised the same set as previously described in the *Discriminant Analysis Assessment* section. Case populations were initially assessed with the first of the two *primary criteria* – country food production (lbs per person), divided into four threshold levels (“very high,” “moderately high,” “moderately low,” or “very low”). Following classification rules, case populations with “very high” country food production were classified “rural” and cases with “very low” country food production were classified “non-rural.” Of 195 case populations, 171 cases (88%) were categorized using the first standard. Of these, 126 cases were classified as “rural”, and 45 cases were classified as “non-rural.” Of the 24 “uncertain” cases, 13 had “moderately low” country food production and 11 had “moderately high” country food production.

Following the test procedure, the 24 unclassified cases were jointly assessed with both primary criteria. Case populations with “sparsely-populated, open country” and “moderately high” country food production were categorized as “rural.” Cases without “sparsely-populated, open country” and “moderately low” country food production were categorized as “non-rural.” Ten of the 24 unclassified cases were categorized as “rural” and five were classified as “non-rural”. There remained only nine cases unclassified –

eight with “moderately low” country food production in “sparsely-populated, open country” and one with “moderately high” country food production and without “sparsely-populated, open country.” The unclassified cases included six populations along roads near a rural/non-rural fringe, one mid-sized, geographically-separate population, and two small communities.

For demonstration purposes, we examined how the nine unclassified cases would be assessed using the three *ancillary criteria* selected for purposes of this study: *other extensive land uses, noncommercial fishery or hunt center*, and a *preponderance of other rural features*. In the step-by-step procedure, a case meeting one or more of the ancillary criteria was classified as “rural.” A case having no other rural feature was classified as “non-rural.” In actual implementation of this methodology, ancillary criteria would be determined by the Federal Subsistence Board and examined using existing data sets, case method material, and public comment.

Because measures for ancillary variables may be unavailable for many Alaska populations, rigorous statistical comparisons of cases may not be possible for certain ancillary measures. Instead, ancillary variables may be assessed through a procedure called *Case Method Assessment*. In case method assessment, detailed qualitative and quantitative information is gathered on a set of case populations, commonly across a range of key variables. The purpose is to describe a few cases in substantial detail so as to understand relationships among variables specific to that set of cases. The information on cases is presented as a narrative accompanied with charts, graphs, maps, and other exhibits.

Conclusions and Recommendations

Two primary factors were identified for separating communities into “rural” and “non-rural” groups -- *country food production for local consumption* and *sparsely-populated, open country in the local commons*. Each factor is consistent with common and scientific meanings of “rural.” A population regularly supported by extensive land uses (such as country food production, commercial fishing, forestry, and so forth) within a sparsely-populated, open country is “rural.” A population with both features is doubly qualified. Conversely, a population not supported by extensive land uses within a relatively densely-populated area is “non-rural,” failing two of the primary features. Populations displaying a mix of features are of less certain classification and need additional assessment with *ancillary factors*.

Two alternative methodologies for distinguishing between rural and non-rural communities for subsistence management were developed and tested in this project. One methodology, called *Discriminant Analysis Assessment*, identified factors that statistically separate communities into two discrete groups. Using these factors, an Alaska population can be classified into the group it most closely resembles. The second methodology, called *Criterion-Referenced Assessment*, established rural/non-rural standards for a set of

factors. By applying these factors, an Alaska population can be categorized based on its characteristics relative to the standards.

The methodology tests were conducted only to examine whether the methods worked and how results from each compared to the other. They were not meant to and do not indicate which communities should actually be determined to be rural and non-rural. That requires further decisions as to methodology and implementation.

Classification outcomes under the tested methodologies were identical in 186 (95%) cases, with the additional 9 cases (5%) needing assessment with ancillary criteria. Thus, the two primary factors -- *country food production for local consumption* and *sparsely-populated and open country in the local commons* -- separated most Alaska populations into distinct rural or non-rural groups. With a few exceptions, the test classifications were consistent with rural/non-rural classifications in current federal regulations. The relative consistency among the outcomes of the three methods provides confidence in the use of any one of the methodologies.

The *Discriminant Analysis Assessment* method worked effectively in applying its two-step procedure, under which rural and non-rural classes are first statistically established and then cases are classified into its nearest group. However, the reflexivity of groups and cases and its changeable discriminant functions, which adjust depending upon the starting set of cases and statistical conditions, may make the approach appear less stable in comparison with the absolute standards applied in *Criterion-Referenced Assessment*.

Discriminant Analysis Assessment uses statistically complex procedures that are less likely to be understood by interested parties, for it requires statistical knowledge not possessed by the general public. As a result, the methodology's complexity creates potential barriers for its acceptance as a way to categorize communities for subsistence eligibility. Furthermore, it leaves a certain number of cases unclassified, necessitating recourse to the criterion based method.

Criterion-Referenced Assessment, on the other hand, is based on deductive reasoning and resembles approaches commonly used to determine eligibility in other government programs. A set of absolute standards for eligibility is defined and applied on a case-by-case basis to applicants (in this instance, case populations). In the test, the classifications of a relatively small set of populations were uncertain, most of them in populations near a rural-urban fringe. A set of *ancillary factors* was identified for additional assessment when a population or area could not be clearly classified with the primary factors. Overall, the assessment method was found to be reasoned, straightforward, and familiar.

The two assessments methods are relatively methodical, quantitative classification systems, drawing on additional qualitative information when assessing uncertain cases. Under each approach, a population regularly supported by wild food production within a sparsely-populated, open country is considered "rural."

The following policy and implementation recommendations emerge from the analysis of methodologies for rural/non-rural determinations for subsistence management in Alaska.

Recommendation 1. *Criterion-Referenced Assessment* is recommended as the preferred methodology for identifying rural and non-rural populations for subsistence management, over *Discriminant Analysis Assessment*.

Because of its simplicity, *Criterion-Referenced Assessment* is the preferred methodology over *Discriminant Analysis Assessment* for distinguishing rural and non-rural populations for subsistence management in Alaska. Since the two methods produce similar outcomes, the more direct approach is preferable for a government program. Stakeholders will be able to readily comprehend the basis of classifications that affect them. Stakeholders are more likely to trust a system that is easily understood than one that is not.

Recommendation 2. *Discriminant Function Analysis* should be used periodically to validate the standards applied in the *Criterion-Referenced Assessment* method.

The case classifications from a criterion-referenced assessment may be used to form the initial groups in a discriminant function analysis. The resultant classifications from the discriminant analysis can be used to assess the relative validity of the rural and non-rural groups. Substantial differences between classifications may indicate a need for adjustments of threshold standards for primary factors.

Effective implementation of the recommended and alternative methodologies also calls for the following policies and actions.

Recommendation 3. Population densities used in rural/non-rural assessment should be calculated for 30-mile standard areas using units comparable to census tracts or CDP census units, whichever provides finer resolution in an area.

Using information in the 2000 federal census, *sparsely-populated, open country in the local commons* was measured for test purposes by population density (weighted by distance) within a standard area. Densities calculated with 30-mile areas surrounding census tracts or CDP census units produced discriminant analysis runs with the best statistical performance, as indicated by the largest canonical correlations among 14 discriminant analysis runs of the Final Report.

Recommendation 4. Population densities should be calculated for case populations using a GIS program.

In our analysis of methodologies, some population densities were calculated without a GIS program. Calculating densities with a GIS program will provide more precise

measures for this factor across all Alaska populations. This is particularly important for cases where uncertainty arise as to rural/non-rural classification.

Recommendation 5. For road-connected populations of the Kenai Peninsula, harvest estimates from Alaska state harvest tickets/permit records and the Community Profile Database should be validated with systematic surveys with higher response rates.

Using information from Alaska Department of Fish and Game databases, we measured *country food production* by annual per capita harvests within a population, expressed as usable weights (lbs), or as the percentage of the RDA for protein contained in the annual harvest. Existing harvest data appear to be affected by substantial non-response rates for some areas. Several Kenai Peninsula populations lie on the fringes of rural and non-rural areas, and more precise harvest estimates help clarifying boundaries between areas.

Recommendation 6. For unsurveyed populations off the road network in Alaska, country food production should be estimated using information from nearby surveyed communities.

Country food production has not been documented for a substantial number of Alaska communities. Where information is missing, country food production levels from nearby surveyed communities may provide adequate estimates for making rural and non-rural assessments in off-road areas.