

THE STRATIFICATION PROCESS

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STRATIFICATION

Land-use stratification is the division of a land area into broad land-use categories. The major land uses we distinguish are cultivation, natural vegetation or range, cities, non-agricultural land and large bodies of water. Each of the major land uses can be subdivided into various substrata (separate strata for individual crops in agricultural areas, for example). Stratification in this way makes for more efficient sampling and estimates for livestock, crop, and farm counts.

To complete construction of the land-use frame, each substratum is further subdivided into primary sampling units (specific land areas with an assigned number of sampling units). Sampling units are then selected at random for enumeration.

The materials used in the stratification process include aerial photography, satellite imagery, topographic and county maps, and other available agricultural information and statistics.

Land-use strata are separated by boundaries identifiable on Landsat, supplemental maps and aerial photography. These boundaries must be visible on the ground so that accurate information can be collected during segment enumeration. Acceptable boundaries include roads, railroads, and rivers. Since the land-use sampling frame cannot be revised each year, permanent boundaries must be used.

Each defined stratum should be used as a target for locating a particular type of land use. The stratum must be as homogeneous as possible throughout the state. (Homogeneous = meaning each strata is accurately representing the percentage of cultivation of the strata definition.

Once the boundaries have been drawn on the aerial photography or topographic maps they are transferred to the county maps for use as the area sampling frame.

STRATUM BOUNDARIES

Land-use strata are separated by boundaries which we identify on Landsat, aerial photography, topographic and county maps. In many cases these stratum boundaries will be used as segment boundaries. To assure that accurate information can be collected during segment enumeration, boundaries must be identifiable on the ground. Since the sampling frame cannot be revised each year, it will be necessary to choose boundaries that are permanent. These boundaries must be identifiable for as long as the frame is in existence (ten to fifteen year average).

The following is a list of physical geographic features which represent strata boundaries. The list is ranked from highest to lowest:

1. Paved Highways
2. Secondary all weather roads
3. Railroads

4. Local farm to market roads (unimproved roads)
5. Permanent rivers and streams
6. Permanent drainage and irrigation canals
7. Visible section lines
8. Trails and internal roads
9. Intermittent streams and rivers or prominent water courses that carry water during or immediately following rains.

Occasionally, when delineating non-agricultural areas it is acceptable to use legal, permanent boundaries recognized within the state. These boundaries often will not be visible on aerial photography. These areas include state and national parks, military bases, large airports, and wildlife refuges.

Do not, under any circumstances, split a field with a boundary.

STRATA DEFINITIONS

Each stratum definition should be used as a target for locating a particular type of land use within a state. A stratum should be as homogeneous as possible throughout the state. Because of boundary and minimum stratum block constraints, it will be impossible to place all land areas into the stratum most appropriate. Small areas of differing land will have to be merged into a single stratum in some cases. Boundary problems, sometimes cause areas of non-agricultural land to be included in areas of agricultural land, thus lowering the percentage of cultivation in the strata block.

Most of the strata definitions will remain constant from state to state. Intensive agricultural strata will be the most subject to change.

COUNTY BOUNDARIES

Prior to starting stratification, all county boundaries must be outlined. For the most part county boundaries do not follow permanent features that are visible on aerial photography. County boundary lines are often straight lines drawn from one point to another or following longitude and latitude lines. It will be necessary to use some permanent physical features in the vicinity. This will entail trading of land areas with bordering counties. With each bordering county, land should be given and taken in roughly equal proportions to avoid expanding a county's total land area.

To find the exact position of the county borders check the topographic maps. Counties that do not follow permanent land features must be changed. Use the aerial photograph along with the topographic maps to determine the best boundaries available. Try to choose boundaries which most efficiently stratify the land. *(Example) a small rural town that is split by a county boundary should be placed entirely in one county. Do the same for small agricultural areas.

Land trade-offs will not occur between states. The state borders must be drawn exactly as they exist on the neighboring state's Area Frame Map.

Draw the boundaries on the photographs. Use a color not used for strata blocks. (ex. black grease pencil) . They can later be changed to the appropriate strata color.

The next step in the stratification process is the delineation of urban, nonagricultural and water areas.

URBAN STRATIFICATION

The following materials are used in Urban Stratification.

*National High Altitude Photographs -(NHAP) individual frame of low-level aerial photography which depicts the land area for a specified location and provides a reference system for ordering enlarged photos.

*County Highway Map -Shows roads, rivers, railroads, section lines, cities, and other important features. Aids in the identification of land features and boundary selection. Note scale, north arrow, and date (most maps have been recently revised).

*Topographic Maps -(Quads, 1:100,000) A larger scale map than the county highway map, shows more detail, useful in city stratification. Note the scale and date.

*Supplemental Materials -These include contact prints (large scale aerial photography) and detailed city maps.

Stratification is done on aerial photos with grease pencil. It is important to keep a sharp point on the grease pencil and to use a straight edge to make lines as thin and straight as possible.

A. Urban Areas

Review the county map to locate all urban centers. Write the names of cities and towns on the County Stratification Log (an information sheet filled out for each county). Locate all urban areas on NHAP'S. Land must have a population density of one hundred or more dwellings per square mile to qualify as urban.

The strata we identify are:

1. Commercial-Residential (32): more than one hundred dwellings per square mile with no agriculture present. This stratum will contain densely populated residential areas and dense commercial areas of large cities. The center of major cities, central business districts, and Main Street, these areas account for most of stratum 32 areas.

Minimum stratum block size for Residential-Commercial is usually .1 square miles.

2. Agri-urban (31): more than one hundred dwellings per square mile, residential mixed with agriculture (usually light ag with small fields). Stratum 31 will occur (1) between urban

areas of large cities and towns (stratum 32) and the open country; (2) in small cities or towns and (3) include industrial and recreation areas, parks and golf courses and airports.

Not all areas with one hundred or more dwellings will be placed in an urban stratum. Some densely populated agricultural areas will have dwellings numbering over one hundred per square mile dotted along roads. Decide what is the main activity of the land. If fields are large and cultivation appears intensive it will be best to put these areas in an agricultural stratum.

Most stratum 32 areas will be surrounded by land that should be classified as stratum 31. All industrial and non-agricultural developed areas on the periphery of cities will be included in this stratum also.

A stratum 31 minimum stratum block size is .25 square miles.

Some very small but densely populated towns that are composed mainly of city blocks may fit the Residential-Commercial definition.

For all urban strata use maps and photography simultaneously to find good boundaries. Quad maps are the most useful materials available for this purpose. Keep in mind that cities in some areas are growing rapidly. Use the most recent maps/photos to determine the extent of growth. If no recent materials are available and growth is suspected, it may be necessary to move boundary lines for Agri-Urban strata out to account for possible growth. See a reviewer before doing this. Never stretch Residential-Commercial (32) boundaries in this way, however. Areas where dense urban growth is suspected are better left in stratum 31.

Some rapidly growing states may have a separate "Potential-Urban" stratum (34) representing lands that in the next few years are scheduled or expected to be developed. (Maps will be provided showing proposed construction sites in areas where this stratum will apply.)

B. Non-Agricultural

Non -Agricultural Lands (50): lands include areas designated by law for purposes other than agriculture. State and national monuments national parks, game and wildlife refuges, military installations and large airports would be included. Usually these areas have definite, legal boundaries delineated on the county map. These boundaries often do not correspond with features that are visible on the aerial photography, but should be used nonetheless. Other large non-agricultural uses may be placed in stratum 50, these include mining and industry.

Prior to stratifying each state, a list of potential 50's (non-agricultural land) is sent to the state. These areas are checked for agriculture and grazing. If there is no agriculture or grazing in these areas, they are compiled to make the state 50's list.

Make sure no agriculture is present in this stratum. Sometimes land in military installations, near airports, and inside prison boundaries (prison farms) will be used for agriculture. Examine the photography and if agriculture is present do not place in stratum 50. sometimes grazed. Check your 50's list before delineating any 50. Airports will be placed in stratum 50 only if they meet the minimum size restriction (usually two square miles). Airports too small for this stratum will be placed in stratum 31. Small private airstrips should not be delineated and will be placed in the stratum of the surrounding land.

Non-Agricultural area (strata 50) minimum block size is one square mile.

C. Water

Bodies of water (62): Water bodies, greater than one square mile will be placed in stratum 62. Only include water areas that lie within county boundaries. Ocean, ocean bays, and other bodies of water with outlets to the sea will not be included in stratum 62. These areas will not be stratified. Narrow rivers that have over one square mile of surface area will not be taken out because of problems with transferral of these boundaries to smaller scale county maps and to make digitization (a computerized method for measuring delineated land areas) easier.

When a river is used as a stratum boundary, place the boundary line in the center of the river. Do not put the entire river into one stratum. When delineating stratum 62 keep in mind that flooding and drought can temporarily change the size of water bodies. If differences are evident on materials, determine where the permanent boundary should lie. Usually the supplemental maps and Landsat will be reliable sources.

Checking Urban Stratification

Urban Stratification will be checked and reviewed. Reviewing will be done only by designated "reviewers." Others should check and do counties in equal proportion.

When checking make sure all appropriate areas have been delineated, and good boundaries have been used. To check boundaries, compare NHAP'S with quads and other maps. If a boundary on the photography fails to correspond with a feature shown on the map, make sure the boundary used is acceptable. To do this you might have to erase portions of the boundary line. If you erase, re-draw the boundary. If you find something you do not agree with, do not change the stratification. Only suggest changes. Slip the photo into an acetate jacket, and make the suggested changes on the acetate. Discuss these changes with the stratifier. If the stratifier does not agree with them, leave it for the reviewer. The reviewer will later decide what changes should be made and discuss them with the stratifier and the checker.

Communication between the parties involved is important. This will allow us to see what mistakes are being made and will help make our product more consistent.

Material Transfer

After Urban Stratification has been checked, the next step is transfer of the boundaries from the aerial photography to quads and supplementary materials. Transfer the boundaries using colored pencils. After the boundary has been outlined, shade inside the border lightly about 1/4 inch.

If in the material transfer process you find a better boundary than the one used, you may change the stratification with the permission of a reviewer. Material transfer will be reviewed. When reviewing, make sure all urban stratification has been transferred to the available materials. All stratum 32 areas must be transferred to quads. If there is no quad coverage in the county packet, it should be ordered for future transfer. If no quad coverage is available through U.S. Geologic Survey, some other materials should be obtained (Talk to Supervisor).

SATELLITE IMAGERY

The basic tool used in agricultural stratification will be satellite imagery.

Satellite imagery is derived from digital data collected by scanners aboard the satellite. Presently, the imagery product from LANDSAT satellite is used. A scanner mounted on the satellite collects the reflected and emitted energy from the ground. Two types of scanners are used: a multispectral scanner (MSS) and a thematic mapper (TM). The optics of the scanner separate this energy into bands - four for MSS and seven for TM.

The spatial resolution is 60 meters for MSS and 30 meters for TM. The increased number of bands coupled with the much greater resolution makes TM the preferred product for stratification.

LANDSAT will be used primarily to determine cultivated and what crops are present in a county. Theoretically different crops will show different color signatures depending on the stage of growth.

Wheat, for example, will show a brown soil signature prior to the planting of the crop. A light green color follows after planting in the pre-emergence stage. As the crop sprouts a reddish appearance occurs and becomes a deeper red as growth continues. A ripe wheat field will have a greenish-yellow color, becoming greener just prior to harvest. After harvest the field will appear white or tan. Most crops will follow this general pattern.

Crop calendars will be available showing approximate planting, growing, and harvest periods for major crops in the state. If a bright red signature is apparent on LANDSAT in an agricultural area, look on the crop calendar and find what crop is in the growing stage in the season indicated on the LANDSAT scene. If multitemporal coverage (more than one scene of a LANDSAT print) is available follow the crop through its various stages of growth to see if it agrees with the colors outlined for the particular crop. If multitemporal coverage is available for the print(s) covering the county, note the various dates of scenes.

For more about LANDSAT imagery interpretation, see "Landsat Analyst".

Preparing LANDSAT for Use in Stratification

You will be provided with a county overlay, an acetate copy of the county highway map adjusted to the scale of the LANDSAT scene. JES segments (previously enumerated sample segments for which data is available showing land-use percentages) will be drawn in on the county overlay.

Get a clear piece of acetate to fit over the county overlay (cut the clear piece to match) and tape the two pieces together. All your markings will be done on this second piece of acetate using a lumocolor marker. Outline the corners of the county boundary and write the name of the county on the bottom. This will allow for easy alignment. Outside the county boundary trace in a few reference points showing exactly how you aligned the overlay. Follow a well defined river or some other obvious feature for this purpose.

Line up the overlay on the LANDSAT scene using the most obvious features available. Rivers and lakes are the most evident features, but their reliability is suspect due to shifting, drought, and flooding. Still water bodies make the best general reference points and should be used. When using water bodies make sure roads line up accurately throughout the county.

There may be some distortion on the LANDSAT scene causing slight differences between it and the overlay. If the overlay doesn't match up exactly (this is more apt to be the case with larger counties), line up the overlay so as to distribute error evenly. Tape the overlay to the imagery.

AGRICULTURAL STRATIFICATION

The following materials will be used in the Agricultural Stratification procedure in addition to those used in City Stratification:

***JES Segment Data** - Results of sample segments enumerated in past years are provided in printout form. The segments shown should correspond with those drawn on LANDSAT overlay. Individual crops acreages for the segment are given as well as pasture and non-agricultural acreages.

***County Agricultural Data** - Data will be available summarizing county estimates of crop yields. Pasture, crop, non-agricultural, and urban acreages should also be available as well as a number of varied farm counts.

***Reference Maps** - 1:100,000 topographic maps. A larger scale map than the county highway map, shows detailed boundaries, useful in ag stratification. Note scale and date.

*Crop Calendar - Chart showing planting, growing and harvesting periods for major crops in the state.

State Overview - Summary of state land regions, natural resources, industry, specific locations of crops and other information supplied by the state.

*LANDSAT Imagery

*LANDSAT Overlay

*High Altitude Photography

In the agricultural stratification process, initial categorization of land will be based on the amount of cultivation present. Prior to stratifying, it will be useful to make an inventory of land-use percentages. With available county data, determine what portion of the county land area will be devoted to the following uses: cropland, forest, pasture, range, and urban. Fill in the appropriate information on the County Stratification Log. Use the ag-stats to determine the percentage of cultivation in the county. This will give a rough estimation of how much land in the county should be placed in each stratum.

Review LANDSAT imagery and aerial photography. Compare dates of all materials. Remember that the most recent coverage (usually LANDSAT) may show some features not evident on other materials. Check scales so distances can be correlated between the two.

Keeping in mind the strata definitions and land-use percentages earlier outlined, get a general idea of how the county will be stratified.

Start by drawing off the smallest stratum blocks and work up to the larger ones. It is usually easiest to separate the cultivated areas first, and so forth. Use the NHAP and LANDSAT simultaneously. Roughly sketch stratification onto the overlay, then use the NHAP and county map to determine precise boundaries.

Do not assume all features on the county highway map will be visible on the county overlay. Because of difficulties in reproducing some colors and small features on the county map, rivers and streams may not be evident on the overlay.

Work through the county until it is completely stratified. Review the NHAP'S and LANDSAT to make sure all areas have been stratified, that all stratum blocks outlined meet strata definitions, that overlapping areas on aerial photographs agree, and that stratification reflects the land-use percentages outlined from county data and that strata are consistent throughout the county.

Agricultural Strata Definitions

Agricultural strata definitions will change from state to state depending on what types of agriculture are present and how extensive it is. Three broad strata definitions will remain constant. All agricultural strata will be drawn from these broad definitions:

1. **Intensive Agriculture** (10-19): Land with 50% or more cultivated will be placed in this stratum. The major land use is crop production. Crops would include feed grains, food grains, fruits, and other cultivated agricultural products. In major wheat producing states, fallow lands would be considered intensively cultivated. A number of substrata can be outlined from this general category. In some states crop specific strata will be outlined. For example, in Texas individual strata were defined for wheat (14), cotton (15), rice (16), and peanuts (17), in addition to a general stratum (13) where agriculture accounts for over 50% of the land area but less than 50% of the land was devoted to any one crop.

Differentiation can also be made between dry land and irrigated crops or between groups of crops (vegetable or citrus strata, for example). Keys to identifying individual crops or crop types will be determined before work begins in each state.

Field size, shape, and shade differences on NHAP'S and LANDSAT will give clues to determining cultivation, specific crops or groups of crops. JES segment data will also help in crop identification.

Consider locational and topographic characteristics too. A certain crop may be grown exclusively on hillsides or near a water source. Some agricultural uses can be distinguished by relative location. For example, intensive, one-crop agriculture will rarely occur close to a city. More extensive uses like dairying and mixed crops typify these farms, as evidenced by smaller field sizes.

Because of boundary constraints, some uncultivated lands will be included in Intensive Agriculture strata. Small areas of water, pasture, forest, and wasteland may be included if they are too small to remove or lack acceptable surrounding boundaries. Intensive Agriculture will be assigned purple or red colors and will normally have a minimum strata block size of one square miles.

2. **Extensive Agriculture** (20-29): Lands with 15-49% cultivation will be placed in this stratum. The basic land use of stratum 20 is agricultural. Cultivated land is interspersed with "natural cover" (forest, brush, grasses). Fields may be small and scattered, or large fields that aren't surrounded by appropriate boundaries and cannot be placed in Intensive Agriculture will be included in stratum 20.

Extensive Agriculture will be located in fringe areas between intensive agriculture and rangelands, where boundaries are not adequate to put cultivation into Intensive Agriculture

strata. Mountainous valley cultivation where boundaries are troublesome will be placed in this stratum.

Substrata will be defined from this general category. Substrata may be defined on the basis of percentage of agriculture, or crop type. (* In Florida, extensive agriculture was broken into two substrata (21) 33-50% cultivated and (22) 15-33% cultivated) Or it can be separated on the basis of specific crop or crop type.

Extensive Agriculture will be drawn in light blue. The minimum stratum block size is normally 1-2 square miles.

3. **Range and Forest** (40-49): Lands of less than 15% cultivation will be placed in stratum 40. Woodland, range, and open pasture are included. The land will have basically a natural cover. Cropland could be in small fields and widely scattered with no surrounding boundaries facilitating inclusion into an agricultural stratum.

Remember, it will be better to place non-agricultural areas into stratum 20 than agricultural areas into stratum 40. Problems arise if a selected segment from stratum 40 has a lot of agriculture.

Depending on the state, two or more divisions of stratum 40 may be utilized. Basis for the strata differentiation can be the presence of woodland or pasture.

In the western part of the country, stratum 40, range and forest land is also divided into public and private land. Public land which has been leased out by the Bureau of Land Management for private grazing purposes will be included in private land.

We use 1:100,000 Bureau of Land Management maps from USGS to delineate these areas. We use physical boundaries unless the state authorizes us to do other wise. No crops should be evident.

BLM and Forest Service lands that do not contain grazing areas should be placed in a stratum separate from privately owned range, forest, and pasture.

A common mistake made in stratification is the inclusion of large areas of pasture into agricultural strata. Pasture and cropland may appear similar on aerial photographs, but a closer inspection will usually allow for correct identification. Generally, cropland will have a smooth appearance on aerial photography with plow marks sometimes evident. Pasture will usually have a mottled appearance. A field that is dotted with trees should be considered pasture.

Do not assume that all cleared land is intensively cultivated. In some cases pasture and cropland will be difficult to distinguish. Pasture in some areas of the country (Florida, Texas, and the West especially) will often have a smooth appearance similar to cropland. If this occurs, separation may be based on shade differences. Cropland will sometimes appear

brighter, a white color as opposed to a gray for pasture on aerial photographs.

LANDSAT imagery and available pasture and crop data will be useful in distinguishing agricultural lands from pasture.

JES segments will provide help in making this determination. Sketch the segment boundaries on the NHAP as they appear on the county overlay or Seg Maps. Try to determine from the printout what is present in each field in the segment. Look for consistencies in shade and field size on the aerial photography and LANDSAT.

Irrigation (present mainly in the West) will be easily distinguished by round field patterns (Pivot systems) and irrigation canals. Where irrigation is present, make a determination of what crops grown in the county need water. This will aid in distinguishing specific crops. Statistics may be available showing what crops are under irrigation in the county.

When stratifying, always provide additional information on the worksheet explaining how you arrived at your conclusions. For example, if you determined that corn fields can be distinguished on a LANDSAT scene by their reddish appearance, and placed these areas in a corn stratum based on this conclusion, indicate it on the worksheet. Explaining how and why this determination was made. This will help the checker and reviewer as they analyze the county.

Also it will be helpful to explain any inconsistencies from the NHAP to LANDSAT. If some agriculture is evident on the more recently dated LANDSAT imagery that isn't shown on the aerial photography make a note of it or write on NHAP "AG on LANDSAT" or "See LANDSAT". this will clear up any confusion that may arise in the checking and reviewing processes. If a recently constructed road is used as a boundary, indicate this on the worksheet.
Only if the road is visible on the county map and not on the aerial photography

COUNTY BOUNDARIES

Make sure the county boundaries are changed to their appropriate colors and make sure that the boundaries used most efficiently stratify the land.

Agricultural Stratification will be checked and reviewed just as urban stratification was. Check boundaries and stratification keeping in mind county and JES segment data. Make suggested changes in stratification on acetate overlay just as you do when checking urban stratification.

FRAME CONSTRUCTION

After the agricultural stratification has been reviewed the next step is construction of the area frame map. In this process all stratification will be transferred to county maps. The materials used in frame construction include:

- *County Frame Map - Either 1:100,000 topographic map or county highway map.
- *Quad and Supplementary Maps - show city stratification.
- *High Altitude Photography
- *Proportional Dividers - measuring device
- *Zoom Transfer Scope - boundary transfer device
- *Acreage Grid - measuring device

First transfer city stratification boundaries. If the cities have been drawn on quads or supplementary materials transfer these boundaries to the frame map. It is difficult to transfer the detailed city stratification from the photo; use the ZTS (Zoom Transfer Scope). After drawing the strata boundaries lightly shade along the inside part of the boundary about 1/4 of an inch thick so the strata blocks stand out. Lines should be shaded on one side and in the same color of the line.

Go on to progressively larger stratum blocks until all stratification has been transferred. Transfer boundary lines in the color used on the aerial photography.

Accuracy is crucial in this step. Lines must be drawn exactly on the appropriate boundaries used in stratification. Due to photo distortions and inaccuracies on the maps, boundaries may look slightly different. For example, a road may appear to have a slight curve on the photo which isn't shown on the frame map. If this occurs, use the Zoom Transfer Scope or proportional dividers. If there is a large discrepancy between the county map and the aerial photography, consult a reviewer. River routes can change over time and flooding and drought can change the shape of a lake.

Neatness is important in frame construction. Keep a sharp point on your pencils and use a straight edge for drawing lines. Lines should be thin but dark.

Sometimes boundaries used in stratification aren't shown on the county map. If this happens the Zoom Transfer Scope should be used, to accurately transfer the boundary to the map.

Some counties may have more than one map page. For these it is important that lines agree from page to page. * Use a light table to line up maps and draw lines so they meet exactly. Overlapping areas on map pages should be traced.

County Boundaries

The county boundaries have already been determined. Check the bordering counties to see if frame construction has been completed. If so, boundaries will be transferred just as they are on the bordering county; always checking for accuracy. Do not draw in these boundaries freehand. Be sure to use the color of the appropriate stratum in your county. An orange (stratum 40) county boundary on one county map be a light blue (stratum 20) boundary on the next counties boundary.

When transferring the county boundary to the frame map, use a light table and the bordering county's frame map so boundaries drawn outside the county will match up with the features on the bordering county's frame map. Make sure county boundaries, which most efficiently stratify the land, are used. It is acceptable to draw straight line county boundaries through stratum 62. Split a stratum 62, however, when there is at least one square mile of surface water area on each side of the boundary. If it is too small on one side, put the entire body of water in one county.

Checking Frame Construction

Since accuracy is more crucial in this step than any other in Stratification, checking the frame thoroughly is a must. Make sure all boundaries have been transferred accurately and that all strata on the photo have been accounted for.

PRIMARY SAMPLING UNIT CONSTRUCTION

Following frame construction, stratum blocks will be broken into smaller sections (primary sampling units). Each stratum will have minimum and maximum size restrictions. Stratum blocks which exceed the maximum size outlined will be broken into primary sampling units. The primary sampling units should conform to these size restrictions.

Target sizes will be outlined for each stratum as well. For example, if stratum 10 has a minimum PSU size of two square miles and a maximum of ten, the target size might be six to eight square miles. If boundaries allow, make PSU for the desired (target) size, but do not sacrifice good boundaries to accommodate the desired size range. PSU's should conform to the minimum and maximum sizes.

For the most part PSU boundaries will be found on the frame map. If sufficient boundaries are not on the map check the aerial photography or 1:100,000 map to find appropriate boundaries. Primary Sampling Unit boundaries will be subject to the same criteria that strata boundaries are. Permanent boundaries must be used. Use the ZTS for boundaries not appearing on the frame maps. Primary sampling unit boundaries are outlined in yellow on the county map. They should not be shaded.

Make PSU's as rectangular as possible. Identification of the primary sampling unit will be easier if this is done. After delineating primary sampling units, they will be assigned numbers for identification purposes. Primary sampling units will have two numbers-first the stratum number then the PSU sequence number. Numbering will be done in the following manner: 10-1, 10-2, 31-3, 20-4, 10-5,....

The numbering sequence will start in the northeast corner of the county and work west continuing through the county in a serpentine fashion. Numbers should be put out in the open, preferably in the center of the count unit so they can be easily seen. Some PSU's may be too small to accommodate a number, if so place the number outside the PSU, making it clear which PSU the number belongs to.

***Numbers should be done in the color of the stratum.**

If a PSU is on more than one county frame map page place the PSU number on both pages. Do not number stratum 62 in its serpentine sequence. Wait and number these areas after all other strata have been numbered. Stratum 62 units will then be added on at the end of the numbering sequence. If there are two or more stratum 62 units in the county, they will be numbered also in a serpentine manner starting from the northeast corner of the county.

Checking and Reviewing

When checking Primary Sampling Unit Construction be sure that the correct stratum numbers have been assigned to PSU's, that no PSU's have been overlooked in the numbering sequence, and that no numbers have been skipped or repeated. These are the most commonly made errors in this process. It is important that these errors be caught.