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Procedure for making a mining claim density map
from BLM claim recordation digital data

by

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INTRODUCTION

This report provides the information needed to generate a mining claim density map from Bureau of Land Management (BLM) mining claim recordation digital data files. A mining claim density map shows the number of mining claims per section (square mile) that have been located on public lands. Mining claim density maps may be used for geographic information system (GIS) based regional mineral assessments. This report includes a brief description of the BLM mining claim database and an outline of the procedures that may be used to produce a mining claim density map. Definitions of internal BLM computer codes and file structures are given in the appendix of this report.

BLM MINING CLAIM DATABASE

BLM is the official land and mineral ownership record-keeping agency for the Federal government. In accordance with the Federal Land Policy and Management Act of 1976 (FLPMA), all unpatented mining claims are required to be recorded at the appropriate BLM state office. When a mining claim location notice is received by a BLM state office, each claim is assigned a unique BLM serial number. BLM maintains a cumulative computer listing by township, range, and section of all mining claims recorded since 1976. This computer listing is known as the "Mining Claim Recordation System" (MCRS) and is available by specific request from the:

United States Department of Interior
Bureau of Land Management
Mining Claim Recordation System Coordinator
Denver Federal Center, Building 50
Denver, CO 80225-0047

The MCRS database includes information on all mining claims located on public lands administered by the BLM or the U.S. Forest Service (USFS). Mining claim locations in the following fifteen states are included in the MCRS database: Arizona, Arkansas, California, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming.

The MCRS computer database contains four record types consisting of the information

filed by claimants in accordance with mining claim recordation requirements. Every record in the MCRS database contains a BLM serial number field that links information for each mining claim between the four record types. Details of the four record types and BLM codes pertinent to the preparation of mining claim density maps are given in the appendix of this report. The four record types are summarized as follows:

Record Type 1 - Geographic: A list of claims by legal land description that includes a meridian code along with the township, range, section, and quarter-section. It also contains the BLM serial number, the state and county in which the claim was located and BLM numerical codes for the BLM district, BLM resource area, and BLM planning unit.

Record Type 2 - Claim name: A list of the names of claims showing BLM serial number, claim type codes (i.e., lode claim, placer claim, mill site, or tunnel site), date of location, date of recordation, date of assessment work, and a column for closed cases. A case closed date appears only after relinquishment of a mining claim or a formal BLM decision declaring a mining claim null and void has been issued, and the appeal period has expired.

Record Type 3 - Claimant: A list of the names of mining claim owners and the BLM serial number for each claim giving the addresses of all claimants.

Record Type 4 - BLM actions: This list consists of BLM administrative actions showing BLM serial number, case type, BLM action codes, the date of each action, and remarks. Action codes refer to BLM administrative actions taken for each claim, such as land classifications and amendments or modifications to previous administrative actions.

Location notices recorded with BLM are stamped with a serial number and placed in a folder. Amendments, proofs of labor, notices of intent to hold, notifications of change of address, quitclaim deeds, and any other correspondence relating to a claim are put in the folder. This entire package is referred to as a "case file" and is stored in serial number order in the Docket's section of each BLM state office. To inspect a case file or purchase copies of the documents by mail, it is essential to know the serial number of the subject mining claim.

METHODOLOGY

The preparation of a mining claim density map requires that the data in the MCRS database be extracted in a form suitable for plotting in a GIS. Claim locations in the MCRS database are given by the Public Land Survey System (PLSS) i.e., meridian, township, range, section, and subsection. PLSS locations are not easily plotted in a GIS unless an attributed polygon coverage for the area of interest already exists. Digital PLSS maps are available from the USGS, from many sites on the Internet, from commercial vendors, or they can be created by digitizing or scanning methods.

The method described in this report assumes the reader has a basic understanding of the fundamentals of a database program or programming language and a knowledge of a GIS program. This report includes examples created with the software programs

"dBASE" and "ARC/INFO" that were used by the author to produce mining claim density maps. However, the general method described below can be implemented with many other commercially available software programs.

The essence of the procedure for making mining claim density coverages from BLM MCRS digital data is as follows:

Step 1. Load the MCRS data into a database program. The MCRS data are in one ASCII file consisting of the four intermingled record types (Geographic, Claim name, Claimant, and BLM actions) that were summarized above. The MCRS records have a fixed length (84 characters) with each line terminated by a "hard return" and "line feed". In dBASE create a file structure with a "character" field that is 84 characters long (this field is named "LONG" in the example below). If the MCRS data file is named "mcrs.txt", then the following dBASE commands will load the MCRS data into a new data file named "base.dbf":

```
use base.dbf  
append from mcrs.txt type sdf
```

The MCRS database for a western State, such as Nevada, will have more than 500,000 records and amount to more than 100 Megabytes of data.

Step 2. Separate the BLM claim recordation data into four ASCII text files. One data file for each of the four record types in the MCRS database, i.e. Geographic, Claim name, Claimant, and BLM actions. The "record type" field is used to group records with the same file structure. This field is named "R_TYP" in the examples in the appendix of this report. The "R_TYP" field is three characters long and is located at positions 12, 13, and 14 in the 84 character field named "long" created in step 1. The following dBASE commands will create the four ASCII files:

```
copy to blm_010.txt type sdf for substr(LONG,12,3) < '020'  
copy to blm_020.txt type sdf for substr(LONG,12,3) > '019' .and. substr(LONG,12,3) < '100'  
copy to blm_100.txt type sdf for substr(LONG,12,3) > '099' .and. substr(LONG,12,3) < '200'  
copy to blm_200.txt type sdf for substr(LONG,12,3) > '199'
```

Step 3. Create a file structure for each of the four file types using the names and field lengths given in the appendix of this report. Load each of the four ASCII files created in step 2 into the appropriate database file structure. In dBASE (assuming the four empty files are named "blm_010.dbf", "blm_020.dbf", "blm_100.dbf", and "blm_200.dbf"), the following commands will put data into the four files:

```
use blm_010.dbf  
append from blm_010.txt type sdf
```

```
use blm_020.dbf  
append from blm_020.txt type sdf
```

```
use blm_100.dbf  
append from blm_100.txt type sdf
```

```
use blm_200.dbf
append from blm_200.txt type sdf
```

Step 4. Create an "MTRS" field that is unique for each section. The "MTRS" field will contain the meridian, township, range, and section data for each claim. This field must be identical with the "MTRS" attribute field in the GIS spatial PLSS coverage. For example, if:

```
Meridian = 021 (Mt Diablo Meridian)
Township = 36.2N
Range = 51.0E
Section = 19
```

then the "MTRS" field would be "**021 36.2N 51.0E19**".

In dBASE (assuming blm_020.dbf contains the "Geographic" records), the following commands could be used to fill data into an "MTRS" field:

```
use blm_020.dbf
```

The following is one command continued to the second line:

```
replace all MTRS with M + str((val(substr(TNP,1,4)) / 10),5,1) + substr(TNP,5,1) +
str((val( substr(RNG,1,4)) / 10),5,1) + substr(RNG,5,1) + substr(SEC,2,2)
```

Step 5. Combine the claim type data from the "claim name" file with the location information from the "geographic" file. This step is performed so that the number of claims may be totaled in each section by claim type (the field named "CASE_T") i.e., lode, placer, mill site, or tunnel. The files are combined by relating the claim name file (blm_010.dbf) to the geographic file (blm_020.dbf) by "serial number" (the field common to both files). After the relation is established between the "geographic" and "claim name" file, the fields needed to make a claim density map (MTRS and R_TYP) are copied to a new file. In dBASE the files are related and the desired fields are copied to a new file by the following commands:

```
select 1
use blm_010.dbf
index on SERIAL to ser_010.ndx
use blm_010.dbf index ser_010.ndx alias m
select 2
use blm_020.dbf
set unique on
index on SERIAL to ser_020.ndx
set unique off
use blm_020.dbf index ser_020.ndx alias n
set relation to SERIAL into m
copy to blm.dbf fields SERIAL, MTRS, m->CASE_T, m->COD
```

Step 6. Count the total number of claims in each section. If desired, claims can be totaled by type, e.g. lode, placer, mill sites, tunnel, and for open and closed claims. In dBASE, add a field called TOTAL to the file which will contain the numeric value of the number of claims in each section. Sort the file to order the records according to the MTRS field.

```
use blm.dbf
sort on MTRS to blm_2.dbf
use blm_2.dbf
do count.prg
```

The dBASE program named "count.prg" can be used to total the claims for each section. This count program can be easily modified to count a subset of the total number of mining claims, such as the total number of placer claims per section. The program is as follows:

COUNT.PRG

* This program will total all mining claims which are in the same section, township,
* range, and meridian to a field called TOTAL which must already exist.
* The file must be ordered (sorted) by MTRS.

* set the initial values of the memory variables

```
mMTRS = MTRS
mCLAIM = 0
```

* Count up all the claims for each section and put the value in TOTAL

```
do while .not. eof()
do while MTRS=mMTRS
  mCLAIM = mCLAIM + 1
  skip
enddo
skip -1
replace TOTAL with mCLAIM
mclaim = 0
skip
mMTRS = MTRS
enddo
```

After running the dBASE program "count.prg", a numerical claim count total will appear in the TOTAL field for the last claim counted for each section. Records with no TOTAL values can be eliminated by:

copy to blm_3.dbf fields MTRS,TOTAL for TOTAL > 0

Step 7. Attach the number of mining claims per section (TOTAL field) to the PLSS coverage polygon attribute table by using the "MTRS" field as the linking field common to both files. This can be done by relating the two files on their MTRS fields. If pat.dbf is the PC ARC/INFO polygon attribute table (a dBASE file) and blm_3.dbf is the dBASE file containing the mining claim totals for each section, the following dBASE commands

will add claim totals to the attribute table by establishing a relation on the MTRS field:

```
select 1
use blm_3.dbf
index on MTRS to blm_mtrs.ndx
use blm_3.dbf index blm_mtrs.ndx alias m
select 2
use pat.dbf
modify structure      ****add TOTAL field****
index on MTRS to pat_mtrs.ndx
use pat.dbf index pat_mtrs.ndx alias n
set relation to MTRS into m
replace all TOTAL with m->TOTAL for MTRS = m->MTRS
```

The PLSS GIS coverage with the mining claim count attributes can be plotted using the ARC/INFO subprogram ARCPLOT. The following ARCPLOT commands would draw a mining claim density map:

```
mapextent plss
shadeset colornames
reselect plss polys total > 0 and total < 13
polygonshades plss 73
clearselect
reselect plss polys total > 12 and total < 25
polygonshades plss 104
clearselect
reselect plss polys total > 24
polygonshades plss 110
```

CONCLUDING REMARKS

Mining claim density maps can be produced by methods presented in this report from digital mining claim recordation files obtained from BLM sources that are used to attribute digital versions of existing state PLSS maps. A GIS may be used to form a variety of claim density maps by selecting different attributes, for example, density of only "placer" claims or only "open lode claims" recorded after 1994. These and other new maps constructed by this method are derivative maps that can be used to answer focused questions. Derivative maps produced from State scale mining claim density maps are an appropriate first step to providing a regional context for land management decisions. Mining claim density information is a potential tool to focus further mineral studies and should be part of the basis for land management decisions.

APPENDIX

FILE STRUCTURES AND DATA ELEMENT CODES

CLAIM NAME report file structure

(See step 3. blm_010.dbf.)

| Field Name | Type | Length | Description |
|------------|-----------|--------|--|
| STATE | CHARACTER | 2 | State prefix code to serial number |
| SERIAL | CHARACTER | 9 | BLM serial number |
| R_TYP | CHARACTER | 3 | Record type code |
| CASE_T | CHARACTER | 6 | Case type code (lode, placer, etc.) |
| COMM | CHARACTER | 3 | Commodity (not coded by BLM) |
| CLAIM_NAME | CHARACTER | 20 | Name of claim |
| COD | CHARACTER | 1 | Disposition of case (i.e., C = closed) |
| R_MO | CHARACTER | 2 | Month claim was recorded |
| R_DAY | CHARACTER | 2 | Day claim was recorded |
| R_YR | CHARACTER | 4 | Year claim was recorded |
| L_MO | CHARACTER | 2 | Month claim was located |
| L_DAY | CHARACTER | 2 | Day claim was located |
| L_YR | CHARACTER | 4 | Year claim was located |
| AS_CODE | CHARACTER | 3 | Assessment work code |
| A_MO | CHARACTER | 2 | Month assessment work was done |
| A_DAY | CHARACTER | 2 | Day assessment work was done |
| A_YR | CHARACTER | 4 | Year assessment work was done |
| LAST_ASMT | CHARACTER | 4 | Year of last reported assessment |
| DUMMY | CHARACTER | 10 | Unused field |

Code definitions:

Record type codes (R_TYP)

Each claim has one record and all have the same code.

R_TYP = 010.

Case Type Codes (CASE_T)

Lode = 384101

Placer = 384201

Tunnel site = 384301

Mill site claim = 384401

GEOGRAPHIC report file structure

(See step 3. blm_020.dbf.)

| Field Name | Type | Length | Description |
|-------------------|-------------|---------------|------------------------------------|
| STATE | CHARACTER | 2 | State prefix code to serial number |
| SERIAL | CHARACTER | 9 | BLM serial number |
| R_TYP | CHARACTER | 3 | Record type code |
| M | CHARACTER | 2 | Meridian code |
| S_QUAD | CHARACTER | 5 | Subsection code |
| TNP | CHARACTER | 5 | Township |
| RNG | CHARACTER | 5 | Range |
| SEC | CHARACTER | 3 | Section |
| ST1 | CHARACTER | 2 | First state |
| CO1 | CHARACTER | 3 | First county |
| ST2 | CHARACTER | 2 | Second state (if needed) |
| CO2 | CHARACTER | 3 | Second county (if needed) |
| ST3 | CHARACTER | 2 | Third state (if needed) |
| CO3 | CHARACTER | 3 | Third county (if needed) |
| ST4 | CHARACTER | 2 | Fourth state (if needed) |
| CO4 | CHARACTER | 3 | Fourth county (if needed) |
| DIST | CHARACTER | 2 | BLM district code |
| RA | CHARACTER | 2 | BLM resource area code |
| PU | CHARACTER | 2 | BLM planning unit code |
| DUMMY | CHARACTER | 24 | Unused field |

Code definitions:

Record type codes (R_TYP)

A claim may have multiple records if it lies in more than one section. Records are coded as follows:

- First record = 020
- Second record = 021
- Third record = 022
- Fourth record = 023

Meridian Codes

First Principal Meridian = 001
Second Principal Meridian = 002
Third Principal Meridian = 003
Fourth Principal Meridian = 004
Fifth Principal Meridian = 005
Sixth Principal Meridian = 006
Black Hills Meridian = 007
Boise Meridian = 008
Chickasaw Meridian = 009
Choctaw Meridian = 010
Cimmaron Meridian = 011
Copper River Meridian = 012
Fairbanks Meridian = 013
Gila - Salt River = 014
Humboldt Meridian = 015
Huntsville Meridian = 016
Indian Meridian = 017
Louisiana Meridian = 018
Michigan Meridian = 019
Principal Meridian (Montana) = 020
Mount Diablo Meridian = 021
Navajo Meridian = 022
New Mexico Meridian = 023
St. Helena Meridian = 024
St. Stephens Meridian = 025
Salt Lake Meridian = 026
San Bernardino Meridian = 027
Seward Meridian = 028
Tallahasee Meridian = 029
Utah Meridian = 030
Ute Meridian = 031
Washington Meridian = 032
Willamette Meridian = 033
Wind River Meridian = 034
Ohio River Survey = 035
BTWN Miamis = 036
Muskegon River = 037
Ohio River Base = 038
First Scioto River = 039
Second Scioto River = 040
Third Scioto River = 041
Ellicotts L. = 042
Twelve - MI-SQ = 043
Kateel River Meridian = 044
Umat Meridian = 045
Fourth Principal Meridian WI = 046
W. of G. Miami = 047
US Military Survey = 048
CT West Res. Ohio = 091
Ohio Co Pur - Ohio = 092
Va Military Survey - Ohio = 093
Invalid Land Description = 098
Undefined Land Description = 099

CLAIMANT report file structure

(See step 3. blm_100.dbf.)

| Field Name | Type | Length | Description |
|-------------------|-------------|---------------|------------------------------------|
| STATE | CHARACTER | 2 | State prefix code to serial number |
| SERIAL | CHARACTER | 9 | BLM serial number |
| R_TYPE | CHARACTER | 3 | Record type code |
| O_NAME | CHARACTER | 20 | Claimant's name |
| STR | CHARACTER | 20 | Claimant's street address |
| CITY | CHARACTER | 15 | Claimant's city address |
| STA | CHARACTER | 2 | Claimant's state address |
| ZIP_C | CHARACTER | 5 | Claimant's zip code |
| DUMMY | CHARACTER | 8 | Unused field |

Code definitions:

Record type codes (R_TYP)

Each claim has one record for each owner. The first owner is coded beginning with "100" and are numbered sequentially upward as necessary.

- R_TYP = 100 (first owner)
- R_TYP = 101 (second owner)
- R_TYP = 102 (third owner)

BLM Actions report file structure

(See step 3. blm_200.dbf.)

| Field Name | Type | Length | Description |
|-------------|-----------|--------|------------------------------------|
| STATE | CHARACTER | 2 | State prefix code to serial number |
| SERIAL | CHARACTER | 9 | BLM serial number |
| R_TYPE | CHARACTER | 3 | Record type code |
| ACT_CODE | CHARACTER | 3 | Activity code |
| ACT_MO | CHARACTER | 2 | Month of activity reported |
| ACT_DAY | CHARACTER | 2 | Day activity was reported |
| ACT_YR | CHARACTER | 4 | Year activity was reported |
| ACT_REMARK | CHARACTER | 21 | Remarks concerning activity |
| ACT2_CODE | CHARACTER | 3 | Second activity code |
| ACT2_MO | CHARACTER | 2 | Month second activity was reported |
| ACT2_DAY | CHARACTER | 2 | Day second activity was reported |
| ACT2_YR | CHARACTER | 4 | Year second activity was reported |
| ACT2_REMARK | CHARACTER | 21 | Remarks concerning second activity |
| DUMMY | CHARACTER | 6 | Unused field |

Code definitions:

Record type codes (R_TYP)

Each claim has a record for each BLM administrative action. The first action record is coded 200 and additional records are numbered sequentially upwards for each new action.

R_TYP = 200

R_TYP = 201

Action codes (ACT_CODE)

Action codes are used to track internal administrative actions. Codes typically used include:

ACT_CODE = 125 Application rejected

ACT_CODE = 146 NEPA analysis initiated

ACT_CODE = 311 Relinquishment filed

ACT_CODE = 404 County recordation

ACT_CODE = 500 Geographic name

ACT_CODE = 631 Claim abandoned or declared void