

Aerial Survey Geographic Information System Handbook

Sketchmaps to Digital Geographic Information

November 2005

Forest Health Monitoring
Program



State and Private Forestry
Forest Health Protection



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Figure 2 – ArcInfo PAT File Format – Flown/Not Flown Area Coverages

Corrected data type in fields BEGIN_DATE1, BEGIN_DATE2, BEGIN_DATE2, END_DATE1, END_DATE2, and END_DATE3 to read D (date) rather than I (integer).

Appendix D – Cooperating Agency Codes

Changed MODNR – Missouri Department of Natural Resources to MODC – Missouri Department of Conservation

Appendix E – Damage Causal Agent Codes

Add 21028, sudden oak death, *Phytophthora spp.*

Add 22074, cedar brown pocket rot, *Poria sericeomollis*

Add 22075, Lachnellula canker, *Lachnellula flavovirens*

Add 25074, Delphinella shoot blight, *Delphinella abietis*

Add 80003, five-needle pine decline

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Figure 1 – ArcInfo PAT File Format – Damage Coverages and Appendix A - Definitions of Items in Damage Coverages

Add RPT_YR attribute item with a definition of 4, 4, I
Changed item definition of SURVEY_ID1, SURVEY_ID2 and SURVEY_ID3 to 6, 6, C from 2, 2, I

Figure 2 – ArcInfo PAT File Format – Flown/Not Flown Area Coverages and Appendix B - Definitions of Items in Flown/Not Flown Coverages

Add RPT_YR attribute item with a definition of 4, 4, I

Changed item definition of SURVEY_ID1, SURVEY_ID2 and SURVEY_ID3 to 6, 6, C from 2, 2, I

Changed item name for begin flight date to BEGIN1, BEGIN2, BEGIN3 from BEGIN_DATE1, BEGIN_DATE2, BEGIN_DATE3

Changed item name for ending date of flight to END1, END2, END3 from END_DATE1, END_DATE2, END_DATE3

Changed item name for number of flight days to FL_DAYS1, FL_DAYS2 and FL_DAYS3 from FLIGHT_DAYS1, FLIGHT_DAYS2, FLIGHT_DAYS3.

Changed item name for comments to FL_NOTES from FLIGHT_NOTES.

Appendix D – Cooperating Agency Codes

Add AZFH, Arizona Forest Health Program, University of Arizona

Add NDCNR, Nevada Department of Conservation

Appendix E – Damage Causal Agent Codes

Add 11055, spruce ips, *Ips pilifrons*

Add 11056, Mexican pine beetle, *Dendroctonus mexicanus*

Add 11999, western bark beetle complex

Change 12154, **unknown**, *Thyridopteryx ephemeraeformis* to 12154, **bagworm**, *Thyridopteryx ephemeraeformis*

Change 12171, **unknown**, *Neodiprion edulicolus* to **pinon sawfly**, *Neodiprion edulicolus*

Add 12188, elm sawfly, *Cimbex americana*

Add 12189, june beetle, *Phyllophaga* spp.

Add 12190, hickory tussock moth, *Halisidota caryae*

Add 12191, pin oak sawfly, *Caliroa lineata*

Add 12192, palmerworm, *Dichomeris ligulella*

Add 12193, pitch pine looper, *Lambdina athasaria pellucidaria*

Add 12194, red pine sawfly, *Neodiprion nanulus nanulus*

Add 12195, pine tip moth, *Argyrotaenia pinatubana*

Add 12196, baldcypress leafroller, *Archips goyerana*

- Add 13030, adana tip moth, *Rhyacionia adana*
- Add 14068, European elm scale, *Gossyparia spuria*
- Add 14069, elm scurfy scale, *Chionaspis americana*
- Change 15058, **unknown**, *Prionoxystus robiniae* to
carpenterworm, *Prionoxystus robiniae*
- Add 15083, cottonwood twig borer, *Gypsonoma*
haimbachiana
- Add 15084, southern pine sawyer, *Monochamus titillator*
- Add 15085, banded ash borer, *Neoclytus capraea*
- Add 15086, emerald ash borer, *Agrilus planipennis*
- Add 16049, prairie tent caterpillar, *Malacosoma lutescens*
- Add 16050, jack pine tip beetle, *Conophthorus banksianae*
- Add 17021, jumping oak gall wasp, *Neuroterus saltatorius*
- Change 21028, sudden oak death, *Phytophthora* **spp.** to
Phytophthora **ramorum**
- Add 22076, strumella canker, *Strumella coryneoidea*
- Add 22077, phomopsis blight, *Phomopsis juniperovora*
- Add 22078, fusarium canker of yellow poplar, *Fusarium*
solani
- Add 22079, sterile conk of maple and beech, *Inonotus*
glomeratus
- Add 22080, canker of spruce, *Aleurodiscus* spp.
- Add 22081, birch conk, *Piptoporus betulinus*
- Add 22082, canker, *Discocainia treleasei*
- Add 24030, elm phloem necrosis, *Mycoplasma*
- Add 26013, southern cone rust, *Cronartium strobilinum*
- Add 80004, pinion pine mortality

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Database Requirements

- Add section on Traditional v. Digital Aerial Sketchmapping
- Add in the “Output” section information on acres
summaries and general disclaimers
- Add Requirements for submitting shapefiles
- Map Projection Requirements: Projection and parameters
information now shown using ArcGIS 9 terminology.
- Change projection requirement to Datum NAD83

Add Figure 3: Table properties from the conversion of a properly formatted coverage to a shapefile using ArcGIS v.9 tools

Add Figure 4: Table properties formatted using D-ASM SketchTools v.2.6

Appendix A – Definitions of Items (Attributes) in Damage Coverages

Change dmg_type domain value 2 Mortality to 2 Mortality (Current)

Add dmg_type domain value 11 Previously Undocumented (Old) Mortality

Appendix D – Cooperating Agency Codes

Change MADEM, Massachusetts Department of Environmental Management to MADCR, Massachusetts Department of Conservation and Recreation

Appendix E – Damage Causal Agent Codes

Add 12197, winter moth, *Operophtera brumata*

Add 12198, basswood thrips, *Neohydatothrips tiliae*

Add 12199, noctuid moth, *Xylomyges simplex* (Walker)

Add 14070, magnolia scale, *Neolecanium cornuparvum*

Add 14071, beech blight aphid, *Grylloprociphilus imbricator*

Add 14072, beech woolly aphid, *Phyllaphis fagi*

Change 15086, **emerald ash borer** to **sitka spruce weevil**, *Pissodes sitchensis*

Add 15087, emerald ash borer, *Agrilus planipennis*

Add 15088, hemlock borer, *Melanophila fulvoguttata*

Add 25075, tar spot, *Rhytisma acerinum*

Add 30003, crown fire damage

Add 30004, ground fire damage

Add 41012, elk

Add 41013, deer

Add 41014, feral pigs

Add 41015, mountain beaver

Add 41016, deer or elk

Add 41017, earthworm, *Lumbricidae*

Change **50012**, wild fire to **30001**, wild fire

Add 50018, other geologic event

Add 50019, mechanical (non-human caused)

Change **70002**, human caused fire to **30002**, human caused fire

November 2007 (*following appendices only*)

Appendix D – Cooperating Agency Codes

Add IADNR, Iowa Department of Natural Resources

Add INDNR, Indiana Department of Natural Resources

Add NDF, Nevada Division of Forestry

Add NJAG, New Jersey Department of Agriculture

Add PADCNr, Pennsylvania Department of Conservation and Natural Resources

Appendix E – Damage Causal Agent Codes

Add 12200, pyralid moth, *Palpita magniferalis*

Add 12201 pacific silver fir budmoth, *Zeiraphera sp. Destitutana* (Walker)

Add 12202, red pine needle midge, *Thecodiplosis piniresinosae*

Add 25076, birch leaf fungus, *Septoria betulae*

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<i>Appendix G Forest Type Codes</i>	<i>Error! Bookmark not defined.</i>

Introduction

The purpose of this handbook is to guide the process of incorporating geographic information systems (GIS) into insect and disease aerial survey data storage, reporting, and analysis. The handbook discusses compiling and entering aerial survey sketchmaps into GIS, quality assurance/quality control (QA/QC) issues, and presents the GIS database standards, format, and coding schemes required for entering data into the national Forest Health Monitoring database.

It should be emphasized that a successful aerial survey program is a team effort involving, not only the sketchmappers, pilots, and ground support personnel, but also the people involved in compiling, digitizing, and moving the data into a digital database. Prior to the start of the aerial survey season, GIS personnel should meet with the aerial survey specialists and assist in the development of the aerial survey plan. GIS requirements for map types, coding schemes, definitions, and other data requirements should be identified before the survey is flown. It is hoped this document provides the link between the aerial survey, the Forest Health Monitoring Aerial Survey Standards and the national database, and identifies key GIS considerations that should be incorporated into the aerial survey. The use of GIS should streamline the process of getting the aerial survey sketchmap information into the hands of those who need and use it. These people range from program managers at the national level to land managers and field personnel.

The development of the handbook will be an ongoing process. As technology, policies, fieldwork procedures, aerial survey methods, and Forest Health Monitoring Standards change, the handbook will be revised. The Aerial Survey Standards Working Group hopes this handbook will be a useful reference for the people working with aerial survey data in GIS.

Traditional vs. Digital Aerial Sketchmapping

Traditional aerial sketchmapping is performed using paper maps. Advances in computer and touch-screen display technology have now made it possible to capture aerial observations directly into a format compatible with a GIS database, thereby streamlining the data collection, conversion and processing procedures. The guidelines on the following pages are written with the traditional method in mind. However, many concepts also apply to the digital approach. Detailed information on the operation and use of the Digital Aerial Sketchmapping (D-ASM) system is available online at the following locations:

http://www.fs.fed.us/foresthealth/publications/id/id_tech.html
<ftp://ftp2.fs.fed.us/incoming/rsac/D-ASM/>

Getting Sketchmaps Ready for GIS

The goal is to use a map for aerial sketchmapping that is suitable for use both in the airplane and for digitizing. Choosing the map should be a coordinated effort between the aerial survey and GIS personnel. Compromises may have to be made, but the use of one map for both purposes will result in greater efficiency and eliminate errors that may arise in transferring data between maps of different scales or projections.

The schedule for mapping activities should be coordinated between the sketchmappers and the people doing the GIS work. Prior to the flying season, the aerial survey and GIS personnel should prepare a proposed schedule detailing when sketchmaps will be available for digitizing. The schedule should be realistic and reflect potential problems, such as bad weather that may delay the aerial survey.

Requirements for Sketchmaps

Information on and recommendations for base maps for aerial survey are presented in [A Guide to Conducting Aerial Sketchmapping Surveys](#). The characteristics of the map as they pertain to entering data into GIS are as follows:

- Maps should be at a scale of 1:100,000 or larger (e.g., 1:24,000) for the continental United States. Maps for Alaska may be at a scale of 1:250,000.
- Maps should display a standard projection and coordinate system (e.g., UTM).
- Maps should have a minimum of four points suitable for using as registration points when converting the map to digital form. These points should be tied to the coordinate system on the map.
- The maps should be in good condition. They should be clean and as free from wrinkles and tears as possible. If original survey maps are damaged, the data should be transferred onto a new map suitable for digitizing, though the transfer of data to a new map should be avoided if possible.
- The map should be neat. Features should be drawn using a thin discrete line or point that is clearly visible against the background of the map. Areas should be represented as closed polygons.
- The coding on the map should be clear and complete. Coding should be legible and clearly associated with the correct feature. All features shown should be assigned attributes.
- Adjacent maps should be edge-matched. All lines crossing the edge of the map should match up with the corresponding line on the adjacent map.

- Areas covered by the aerial survey (see the discussion on Flown/Not Flown Areas, later in the guide) should be delineated on the sketchmap(s) or on another map(s) of similar scale. If a separate map is used, it should meet all of the above requirements.

Data Coding

Prior to the beginning of the aerial survey, there should be agreement between the sketchmapping and GIS personnel on the coding scheme to be used on the aerial survey maps. Requirements for coding may be different for different projects or aerial survey missions. Due to the difficulty of recording information on maps during flight, different coding schemes may be needed for recording the data on the sketchmaps from what is used in the GIS database. Coding schemes should take into account the national reporting efforts, and Region or local reporting requirements. There are, at this time, national standards in place for reporting mortality and defoliation that include standard attributes and coding schemes. These coding schemes are presented in the appendices to this guide.

A data dictionary should be developed for use both by the sketchmappers and the GIS personnel. The data dictionary should show each data element required and the characteristics of each element.

The characteristics of a data element are as follows:

- Name of data element
- Description of data element
- Type of data - Integer, decimal number, or alphanumeric character
- Size of field - Number of allowable characters
- Number of decimal places for numeric data
- Allowable codes or entries for alphanumeric data - Allowable values or range for numeric data
- Definitions of codes
- Source or reference for codes
- Crosswalk between codes used on sketchmaps and data entered into GIS. There can be a one to one relationship between map codes and GIS codes or map data may be aggregated into broader categories in GIS.

The data dictionary information will also be used in the metadata for the digital geographic information.

Building Digital Geographic Information

The process of converting hardcopy sketchmaps to digital geographic information involves two steps. The first step is converting the sketchmap data recorded on paper or mylar maps into digital form. The second step is processing the digital data into usable data.

The Forest Services is moving toward the use of geodatabases in an ArcGIS environment. However, ArcInfo coverages are still being used and remain the standard for submitting data into the national database. Shapefiles may also be submitted and requirements for both coverages and shapefiles are detailed on the following pages. Where information relates to both a coverage and a shapefile, the term “dataset” will be used.

Converting Data

The raw aerial survey data is recorded on paper sketchmaps. The data can be converted into digital form either by scanning maps electronically or by digitizing the maps manually. GIS personnel should determine the better method to use based on the individual situation.

Scanning the sketchmaps involves feeding a map into a scanner, which creates a digital file containing all features visible on the map. Scanning may require editing and cleaning of the data before and after scanning. In some cases, sketchmapped data may have to be transferred to another medium (such as a mylar sheet) prior to scanning. After scanning, the electronic file may require "cleanup" to resolve unclear lines.

Digitizing sketchmaps involves transferring sketchmapped data to a digital file selectively. The sketchmap is taped to a digitizing table and a digitizing mouse is used to trace sketchmapped polygons. Digitizing is more labor-intensive than scanning, but requires less "cleanup" of the digital file. Both methods should yield the same result: a clean and accurate digital representation of the sketchmap.

The important factors to keep in mind when either scanning or digitizing are as follows:

- The registration points on the sketchmaps should be used when entering the data into a GIS to ensure that the data is geographically accurate.
- Map projections of the sketchmaps and of the resulting dataset should be considered to ensure accurate data transformations.
- The accuracy of the data on the sketchmap should be maintained in the conversion process.
- The conversion should be both efficient and cost-effective.
- The final dataset should accurately reflect the information on the sketchmaps, with points and polygons on the two matching up.

- The final dataset should be clean (e.g., polygons should be closed, with no gaps or dangling line segments).
- A separate dataset of Flown/Not Flown areas should be created that covers the region of the sketchmaps (may be created by digitizing, scanning, buffering GPS data of flightlines, or other methods).

Data Processing

The dataset created by the conversion process is merely a set of points and polygons. Further processing is necessary to make it usable. The attributes for each point and polygon must be entered and attached to the appropriate feature. Two or more dataset may have to be combined to create a single one for a given project. Datasets may have to be projected into appropriate map projections. The end result of the processing should be a clean dataset that meets the units requirements for use of the aerial survey data. The dataset should also be able to be processed for incorporation into the national GIS aerial survey database. The final section of this document contains information on requirements for the national database.

There are numerous methods of entering attributes into GIS and associating them with the appropriate features. The method used should be based on the individual situation. The attributes are stored in the appropriate feature table in ArcInfo or a table in an Oracle database system. The attributes should be checked back against the sketchmaps to ensure accuracy. This can be accomplished by producing a 'check' map from the GIS showing features with attributes that can be directly compared to the sketchmaps.

If one aerial survey project produces several sketchmaps, the datasets for each map may be combined into one. The datasets to be combined must be in the same map projection. Adjacent maps should have been edgematched prior to converting the maps into digital form. However, additional editing may be necessary. Entering attributes into GIS can be performed either before or after maps have been combined into a single dataset.

Calculations, such as converting areas (usually expressed in meters) to acres, should be performed at the appropriate time, taking into account the processing steps to be performed. For example, calculating trees-per-acre should be performed with accurate acreage figures for the polygon to which the tree count applies. If a polygon spans two or more map sheets, then the polygon segments should be joined before the trees-per-acre figure is calculated. This would also apply to situations in which the damage polygon may be divided during an overlay process such as overlaying damage polygons with county boundaries. Trees per acre should be calculated for the polygon before it is used in an overlay process. Standard conversion factors should be used throughout a project.

Each unit may have different requirements for using the aerial survey data. In producing maps and reports to meet these requirements, datasets may need to be projected into different map projections. ArcInfo provides the tools to achieve this.

The current requirements for delivering aerial survey data to the national GIS database are described in the final section of this document. Map projection parameters, coverages, shapefiles, conversion factors, attributes, and other information are discussed. The information about the attributes includes references to standard coding to be used, and the sources of these coding schemes. All data processing should consider the national reporting effort to ensure that aerial survey data can be submitted to the national database with the appropriate attributes and formats.

Processing Additional Datasets

Individual Forest Service units will have different requirements for additional datasets to accompany the aerial survey data. The only additional dataset required by the national reporting effort is the Flown/Not Flown Areas dataset.

Flight lines are a good example of an additional dataset a unit may require. Flight lines can be used to accurately assess the coverage of an area by the aerial survey. The flight lines may even be used to develop the Flown/Not Flown Areas dataset.

Forest Inventory and Analysis (FIA) and Forest Health Monitoring (FHM) plot locations may be required to produce maps showing the relationship of the aerial survey data to plot locations. In the future, procedures may be developed to use the aerial survey data to assess data collected on these plots, and vice versa. The plot location data should be used with caution due to the sensitive nature of some locations. Due consideration should be given to the level of accuracy of the aerial survey and plot location before using the data together.

Other reference data will probably already exist in a GIS. These datasets are needed to allow further analysis and produce maps showing the aerial survey data in relationship to traditional map features, such as roads, national forest boundaries, etc.

Documentation and Metadata

Documentation of the data-generation process, from starting with sketchmaps through GIS maps and reports, is important. Documentation allows involved parties to track what was done, how it was done, when it was done, and who did it. The documentation also ensures that anyone using the data knows the limitations of the data and will be able to determine appropriate uses of the data.

Documentation really starts in the planning process for an aerial survey project. Ideally, everyone involved in the project should sit down and design the project from data collection to final information. The documentation should be designed into the project and assigned to the responsible parties to ensure completion.

The main tool for documentation is metadata attached to each coverage. Metadata, or data about data, has all the information needed by someone to allow them to use the data correctly. As of this writing, the Forest Service has not adopted an application for handling metadata. However, several are being reviewed that are compliant with the Federal Geographic Data Committee (FGDC) standards. Numerous applications exist that are compliant with FGDC. The application used should be determined by the GIS personnel, but it must be FGDC-compliant.

Most of the documentation for aerial survey data will be handled by the metadata effort. However, additional documentation may be required. The documentation should cover the following main items:

- Where the data comes from, including where and when the data was collected.
- The format of the data at the start of the GIS process including a data dictionary.
- The process used to convert the data to digital format and turn it into geographic information.
- The data parameters needed by anyone using the dataset for analysis.
- The information needed by anyone using the geographic information to make decisions.

Documentation should be readily available. Metadata should be associated with the appropriate dataset and accompany it when it is shared with, or delivered to, another user.

Quality Assurance/Quality Control

The quality assurance/quality control (QA/QC) process should ensure that the conversion of sketchmap data into digital geographic information maintains the accuracy of the original data.

The conversion of the data into digital form and any other GIS processes performed on the data should be checked to ensure that the process maintains data accuracy. The production of a 'check' map to use as an overlay to the sketchmaps for checking the GIS dataset is one method of doing this. The 'check' map also can be used to compare coding on the sketchmap to the GIS coverage.

The coding of all attributes should be checked against the data dictionary to see that all the data are valid. Macros in GIS can be used to check data validity, as can the use of the 'check' map. Any calculations made in GIS should also be checked against the data dictionary, in addition to confirming that the calculation itself is correct.

Production of maps and reports should be based on the accuracy of the data. Maps should not be produced at a significantly larger scale than that at which the data was collected and compiled. Doing this implies an accuracy of the data that is not supported. Information in reports should be reported in the same accuracy as the original data.

The metadata should accompany the GIS dataset. The accuracy of the data is recorded in the metadata, and should serve as a reminder to anyone using the data as to the accuracy of the data.

Output

The only standard outputs from the aerial survey data are the requirements for FHM reporting and the national reporting efforts. Each year various maps and summaries are provided to the FHM Director and other cooperators. Each unit may have its own specific output requirements to state cooperators, national forest personnel and other private parties.

The inherent spatial and attribute inaccuracies in aerial survey data make it imperative that care be taken when producing summaries or maps of any kind. Language such as "acres *with* damage" rather than "acres *of* damage" better explains the qualities of the data.

Summarizing acres by any category can introduce multiple counting issues if care is not taken to avoid it. At the national level, additional attributes are used to identify polygons with multiple attribute sets. Queries to the database are structured so that within a category such as "dmg_type = mortality", a polygon will only get counted once, even if it had two mortality pests present. If however, a single polygon reports a damage type from two different categories (i.e. mortality and defoliation), the same acres will be counted for each category and a "footprint" total will be provided that summarizes the area of all polygons with no multiple counting. National maps contain a note briefly explaining these concepts. It states:

Acres are summarized from the current year's observations only and are not cumulative. Multiple counting of acres may occur between categories if an area is observed to have simultaneous multiple damage types. However, multiple counting of acres does not occur within a category. The "footprint" total represents the affected area on the ground with no multiple counting.

National GIS Database Requirements

A national GIS database for all aerial survey data has been established at the Forest Health Technology Enterprise Team (FHTET) in Fort Collins, Colorado. The purpose of this database is to provide a single source for all aerially detected insect, disease, and abiotic forest damage data to facilitate national and multi-regional level reporting of damage for both Forest Health Monitoring and Forest Health Protection. At this time, the National Aerial Survey Data Standards require only mortality and defoliation data be collected and reported. Many cooperators are collecting data on other damage types; for this reason, the national database has been configured to include those other damage types. The database will contain both current data and, as available, historic data. It is anticipated that, in the future, this database will be expanded to include insect and disease data collected by other means.

The database is built from polygon datasets developed by the Regions/Area and made available each year to the staff at FHTET. Data can be submitted as ArcInfo coverages or shapefiles. The following sections describe formatting requirements.

Datasets

- **Overview Survey** An overview survey is one during which all types of damage are mapped. This, the most common type of survey, normally takes weeks or months to complete, and covers an extensive area. All overview surveys will be delivered as a single polygon coverage or shapefile for each Region/Area, containing all damage data for that calendar year.
- **Special Surveys** Special surveys are flown to capture data on a single insect, disease or abiotic event, and are usually done at a time when the signature for that event is most apparent. These surveys frequently cover a smaller geographic area than an overview survey, and may in fact overlap in area with the overview survey in the same year. Each special survey, or combination of several special surveys for the same insect or pathogen, will be delivered as a separate coverage or shapefile in the same format as the overview survey.
- **Flown/Not Flown Area** Each overview and special survey dataset will be accompanied by a dataset delineating the area or areas surveyed. This dataset is needed to distinguish areas of no damage from areas for which there is no data.

Standard Conversion Factors

When converting area in meters to acres in the GIS, the following formula should be used:

$$\text{Acres} = \text{Area (in square meters)} / 4046.8726$$

Map Projection Parameters

All data should be projected into the Albers Conic Equal Area projection using the following parameters:

For Conterminous 48 States

Projected Coordinate System	USA_Contiguous_Albers_Equal_Area_Conic
Geographic Coordinate System	GCS_North_American_1983
Datum	D_North_American_1983
Spheroid (GRS_1980)	6378137.0, 298.257222101
Prime Meridian (Greenwich)	0.0
Unit (Degree)	0.0174532925199433
Projection	Albers
False Easting	0.0
False Northing	0.0
Central Meridian	96.0
Standard Parallel 1	29.5
Standard Parallel 2	45.5
Latitude of Origin	23.0
Unit (Meter)	1.0

For Alaska

Projected Coordinate System	Alaska_Albers_Equal_Area_Conic
Geographic Coordinate System	GCS_North_American_1983
Datum	D_North_American_1983
Spheroid (GRS_1980)	6378137.0, 298.257222101
Prime Meridian (Greenwich)	0.0
Unit (Degree)	0.0174532925199433
Projection	Albers
False Easting	0.0
False Northing	0.0
Central Meridian	-154.0
Standard Parallel 1	55.0
Standard Parallel 2	65.0
Latitude of Origin	50.0
Unit (Meter)	1.0

Polygon Attribute Table For Damage Coverages

Figure 1 contains the polygon attribute table (PAT) format for aerial survey damage data collected during either overview or special surveys. Appendix A contains descriptions of each data item in the PAT. Example data and an example PAT for damage coverages is contained in Appendix C. The following should be noted about the PAT:

- The standard coding scheme allows for entering up to three aerial survey observations for any one polygon. Each observation is a unique combination of attributes (survey_id1, dmg_type1, severity1, etc.) and is assigned to one of three attribute groups (survey_id1, dmg_typ1... survey_id2, dmg_typ2... survey_id3, dmg_type3...). Data should not be entered into one attribute in a group unless data is entered in all attributes in the group. (See example PAT file in Appendix C.)

Note: If special circumstances call for more than three attribute groups for any one polygon, these may be added to the PAT based on the standard scheme. (Example: SURVEY_ID4, DMG_TYPE4, SEVERITY4....SURVEY_ID6, DMG_TYPE6, SEVERITY6)

- The coding scheme does not require real data in each field of the PAT. Fields with "No Data" may result from the way data was collected or differences between data required by mortality versus defoliation. (See example PAT file in Appendix C.)
- The coding scheme allows for more than one damage type to be entered for any one polygon. Therefore, an acreage summary for all damages may double- or triple-count the area of some polygons. Users should be aware of this, and structure queries so as to avoid it, if desired.
- Acres will be calculated from area using the standard conversion factor shown above.
- The measure of mortality is dead trees per acre (TPA). TPA is entered directly or calculated from the number of trees (the NO_TREES field) divided by acres (the ACRES field). In those cases where trees per acre (TPA) is recorded and entered directly, the number of trees (NO_TREES) field is calculated from TPA multiplied by ACRES.
- Additional items, may be added at the national level during the combining of data from all the Regions/Area.

Figure 1: ArcInfo PAT File Format - Damage Coverages (Overview and Special Surveys)

Item Name	Input Width	Output Width	Type	No. Dec	Description
AREA	4	12	F	3	Item generated by ArcInfo
PERIMETER	4	12	F	3	Item generated by ArcInfo
COVERAGE#	4	5	B		Item generated by ArcInfo
COVERAGE-ID	4	5	B		Item generated by ArcInfo
RPT_YR	4	4	I		Year of survey
SURVEY_ID1	6	6	C		Unique Survey Identifier
SURVEY_ID2	6	6	C		Unique Survey Identifier
SURVEY_ID3	6	6	C		Unique Survey Identifier
DMG_TYPE1	2	2	I		Damage Type Code
DMG_TYPE2	2	2	I		Damage Type Code
DMG_TYPE3	2	2	I		Damage Type Code
SEVERITY1	2	2	I		Defoliation Severity Code
SEVERITY2	2	2	I		Defoliation Severity Code
SEVERITY3	2	2	I		Defoliation Severity Code
PATTERN1	2	2	I		Defoliation Pattern Code
PATTERN2	2	2	I		Defoliation Pattern Code
PATTERN3	2	2	I		Defoliation Pattern Code
TPA1	7	7	N	2	Dead Trees Per Acre
TPA2	7	7	N	2	Dead Trees Per Acre
TPA3	7	7	N	2	Dead Trees Per Acre
NO_TREES1	7	7	I		Number of Dead Trees
NO_TREES2	7	7	I		Number of Dead Trees
NO_TREES3	7	7	I		Number of Dead Trees
DCA1	5	5	I		Damage Causal Agent Code
DCA2	5	5	I		Damage Causal Agent Code
DCA3	5	5	I		Damage Causal Agent Code
HOST1	4	4	I		Host Tree Species Code
HOST2	4	4	I		Host Tree Species Code
HOST3	4	4	I		Host Tree Species Code
FOR_TYPE1	4	4	I		Forest Type Code
FOR_TYPE2	4	4	I		Forest Type Code
FOR_TYPE3	4	4	I		Forest Type Code
ACRES	4	12	F	1	Calculated Acres Based on AREA
NOTES	60	60	C		Comments

Polygon Attribute Table For Flown/Not Flown Coverages

Figure 2 contains the polygon attribute table (PAT) for the flown/not flown coverage. The purpose of the coverage is to enable users to differentiate between areas that were surveyed and contained no damage and those areas for which no survey was flown. Each damage coverage should be accompanied by a flown/not flown coverage. As with the PAT for damage coverages, this attribute coding scheme provides for up to three attribute groups per polygon to allow for overlaps, multiple agencies, multiple surveyors, etc. As with the damage coverages, data should not be entered into one attribute in a group unless it is entered into all attributes in a group. The coding scheme does not require real data in each field. Appendix B contains descriptions of each Flown/Not Flown Area data item in the PAT.

Figure 2: ArcInfo PAT File Format - Flown/Not Flown Area Coverages

Item Name	Input Width	Output Width	Type	No. Dec	Description
AREA	4	12	F	3	Item generated by ArcInfo
PERIMETER	4	12	F	3	Item generated by ArcInfo
COVERAGE#	4	5	B		Item generated by ArcInfo
COVERAGE-ID	4	5	B		Item generated by ArcInfo
RPT_YR	4	4	I		Year of survey
SURVEY_ID1	6	6	C		Unique Survey Identifier
SURVEY_ID2	6	6	C		Unique Survey Identifier
SURVEY_ID3	6	6	C		Unique Survey Identifier
FLOWN1	2	2	I		Flown/Not Flown Code
FLOWN2	2	2	I		Flown/Not Flown Code
FLOWN3	2	2	I		Flown/Not Flown Code
AGENCY1	10	10	C		Responsible Agency
AGENCY2	10	10	C		Responsible Agency
AGENCY3	10	10	C		Responsible Agency
SURVEYOR1	30	30	C		List of Aerial Surveyors
SURVEYOR2	30	30	C		List of Aerial Surveyors
SURVEYOR3	30	30	C		List of Aerial Surveyors
BEGIN1	8	8	D		Beginning Date of Flight
BEGIN2	8	8	D		Beginning Date of Flight
BEGIN3	8	8	D		Beginning Date of Flight
END1	8	8	D		Ending Date of Flight
END2	8	8	D		Ending Date of Flight
END3	8	8	D		Ending Date of Flight
FL_DAYS1	3	3	I		Number of Days for the Survey
FL_DAYS2	3	3	I		Number of Days for the Survey
FL_DAYS3	3	3	I		Number of Days for the Survey
PURPOSE1	30	30	C		Purpose of the Flight
PURPOSE2	30	30	C		Purpose of the Flight
PURPOSE3	30	30	C		Purpose of the Flight
FL_NOTES	60	60	C		Comments

Polygon Shapefiles

Data may also be submitted as shapefiles. Attribute naming conventions and coding schemes follow those described in the coverage section. In addition, any submitted shapefile must meet the following criteria:

- It must be a polygon shapefile.
- Each polygon must have a unique ID number.
- Polygons must be clean (e.g., closed with no gaps or dangling line segments) with no overlapping of adjacent polygons.
- The shapefile must have an accompanying projection file (.prj) with the appropriate Albers projection information.
- Standard attribute field properties must be compatible with the following tables.

Figure 3: Table properties from the conversion of a properly formatted coverage to a shapefile using ArcGIS v.9 tools

Field Name	Type	Length	Precision	Scale
RPT_YR	Short Integer	4	4	0
SURVEY ID1,2,3	Text/String	6	0	0
DMG_TYPE1,2,3	Short Integer	2	2	0
SEVERITY1,2,3	Short Integer	2	2	0
PATTERN1,2,3	Short Integer	2	2	0
TPA1,2,3	Float	7	6	2
NO_TREES1,2,3	Long Integer	7	7	0
DCA1,2,3	Long Integer	5	5	0
HOST1,2,3	Short Integer	4	4	0
FOR_TYPE1,2,3	Short Integer	4	4	0
ACRES	Float	13	12	11
NOTES	Text/String	60	0	0

Field Name	Type	Length	Precision	Scale
RPT_YR	Short Integer	4	4	0
SURVEY ID1,2,3	Text/String	6	0	0
FLOWN1,2,3	Short Integer	2	2	0
AGENCY1,2,3	Text/String	10	0	0
SURVEYOR1,2,3	Text/String	30	0	0
BEGIN1,2,3	Date	8	0	0
END,2,3	Date	8	0	0
FL_DAYS1,2,3	Short Integer	3	3	0
PURPOSE	Text/String	30	0	0
FL_NOTES	Text/String	60	0	0

Figure 4: Table properties formatted using D-ASM SketchTools v.2.6¹

Field Name	Type	Length	Precision	Scale
RPT_YR	Short Integer	4	4	0
SURVEY ID1,2,3	Text/String	6	0	0
DMG_TYPE1,2,3	Short Integer	4	4	0
SEVERITY1,2,3	Short Integer	4	4	0
PATTERN1,2,3	Short Integer	4	4	0
TPA1,2,3	Float	7	6	2
NO_TREES1,2,3	Long Integer	7	7	0
DCA1,2,3	Long Integer	5	5	0
HOST1,2,3	Short Integer	4	4	0
FOR_TYPE1,2,3	Short Integer	4	4	0
ACRES	Double	12	11	1
NOTES	Text/String	60	0	0

Field Name	Type	Length	Precision	Scale
RPT_YR	Short Integer	4	4	0
SURVEY ID1,2,3	Text/String	6	0	0
FLOWN1,2,3	Short Integer	4	4	0
AGENCY1,2,3	Text/String	10	0	0
SURVEYOR1,2,3	Text/String	30	0	0
BEGIN1,2,3	Date	8	0	0
END1,2,3	Date	8	0	0
FL_DAYS1,2,3	Short Integer	4	4	0
PURPOSE	Text/String	30	0	0
FL_NOTES	Text/String	60	0	0

¹ Digital Aerial SketchMapping SketchTools v2.6, Schrader-Patton, C., April 2005, USDA Forest Service, RSAC. Online at: http://www.fs.fed.us/foresthealth/publications/id/id_tech.html and <ftp://ftp2.fs.fed.us/incoming/rsac/D-ASM/>.

Appendix A Definitions of Items (Attributes) in Damage Coverages

Attribute label: area perimeter coverage# coverage-id

Definition (description): Items generated by ArcInfo

Attribute label: survey_id1 survey_id2 survey_id3

Definition (description): Unique identifier for survey project

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Domain Value: -1 No data

User-defined numeric/alphanumeric code

Format Type: Character

Format Length: 6

Attribute label: rpt_yr

Definition (description): Year the survey was flown

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Domain Value: YYYY four digit year

Format Type: Integer

Format Length: 4

Attribute label: dmg_type1 dmg_type2 dmg_type3

Definition (description): Damage type identification code

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Domain Value: -1 No Data

1 Defoliation

2 Mortality (Current Year)

3 Discoloration

4 Dieback

5 Topkill

6 Branch Breakage

7 Main Stem Broken/Uprooted

8 Branch Flagging

9 No Damage

10 Other Damage

11 Previously Undocumented (Old) Mortality

Format Type: Integer

Format Length: 2

Attribute label: severity1 severity2 severity3

Definition (description): Defoliation severity code

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Domain Value: -1 No Data

1 Low (Equal to or Less than 50 % defoliation)

2 High (More than 50 % defoliation)

Format Type: Integer

Format Length: 2

Attribute label: pattern1 pattern2 pattern3

Definition (description): Defoliation pattern code

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Domain Value: -1 No Data

- 1 Host type or species is > 50 % and the damage is contiguous (relatively continuous)
- 2 Host type or species is > 50 % and damage is patchy (concentrated in discrete pockets or individual trees)
- 3 Host type or species < 50 % and damage is continuous
- 4 Host type or species < 50 % and damage is scattered

Format Type: Integer

Format Length: 2

Attribute label: tpa1 tpa2 tpa3

Definition (description): Dead trees per acre - measure of mortality

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Domain Value: -1 No Data

0 to 9999.99 User-defined

Format Type: Numeric

Format Length: 7

Decimal Places: 2

Attribute label: no_trees1 no_trees2 no_trees3

Definition (description): Number of dead trees detected - measure of mortality

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Domain Value: -1 No Data

0 to 9999999 User-defined

Format Type: Integer

Format Length: 7

Attribute label: dca1 dca2 dca3

Definition (description): Damage-causing agent code

Source: USDA Forest Service, FMSC, "FSVeg - Field Sample Vegetation Data Dictionary" version 1.3

Domain Value: 99999 No Data

0 to 99999 User-defined

Format Type: Integer

Format Length: 5

Attribute label: host1 host2 host3

Definition (description): Host tree species code

Source: USDA Forest Service, Environmental Monitoring and Assessment Program (EMAP) FHM Manual (Eastern and Western), Appendix A

Domain Value: -1 No Data

0 to 9999 User-defined

Format Type: Integer

Format Length: 4

Attribute label: for_type1 for_type2 for_type3

Definition (description): Forest Type Code

Source: USDA Forest Service, EMAP FHM Manual (Eastern and Western) Appendix C

Domain Value: -1 No Data
0 to 9999 User-defined

Format Type: Integer

Format Length: 4

Attribute label: acres

Definition (description): Area in Acres of the Polygon

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Domain Value: -1 No Data
0 to 999999.9 User-defined

Format Type: Floating Point

Format Length: 12

Decimal Places: 1

Attribute label: notes

Definition (description): Notes (comments)

Format Type: Character

Format Length: 60

Appendix B Definitions of Items (Attributes) in Flown/Not Flown Coverages

Attribute label: area perimeter coverage# coverage-id

Definition (description): Items generated by ArcInfo

Attribute label: survey_id1 survey_id2 survey_id3

Definition (description): Unique identifier for survey project

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Domain Value: -1 No Data

User-defined numeric or alphanumeric code

Format Type: Character

Format Length: 6

Attribute label: rpt_yr

Definition (description): Year the survey was flown

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Domain Value: YYYY four digit year

Format Type: Integer

Format Length: 4

Attribute label: flown1 flown2 flown3

Definition (description): Code identifier for areas flown or not flown

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Domain Value: -1 No Data

0 Not Flown

1 Flown

Format Type: Integer

Format Length: 2

Attribute label: agency1 agency2 agency3

Definition (description): Acronym identifier for agency responsible for flight

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook (see List below)

Format Type: Character

Format Length: 10

Attribute label: surveyor1 surveyor2 surveyor3

Definition (description): List of aerial surveyors

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Format Type: Character

Format Length: 30

Attribute label: begin1 begin2 begin3

Definition (description): Beginning date for survey flown

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Domain Value: -1 No Data

YYYYMMDD Date format

Format Type: Date

Format Length: 8

Attribute label: end1 end2 end3

Definition (description): Ending date for survey flown

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Domain Value: -1 No Data

YYYYMMDD Date format

Format Type: Date

Format Length: 8

Attribute label: fl_days1 fl_days2 fl_days3

Definition (description): Number of days from beginning of survey to end of survey

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Domain Value: -1 No Data

1 to 999 User-defined

Format Type: Integer

Format Length: 3

Attribute label: purpose1 purpose2 purpose3

Definition (description): Purpose of aerial survey

Source: USDA Forest Service, FHM Aerial Survey codes, GIS Handbook

Format Type: Character

Format Length: 30

Attribute label: fl_notes

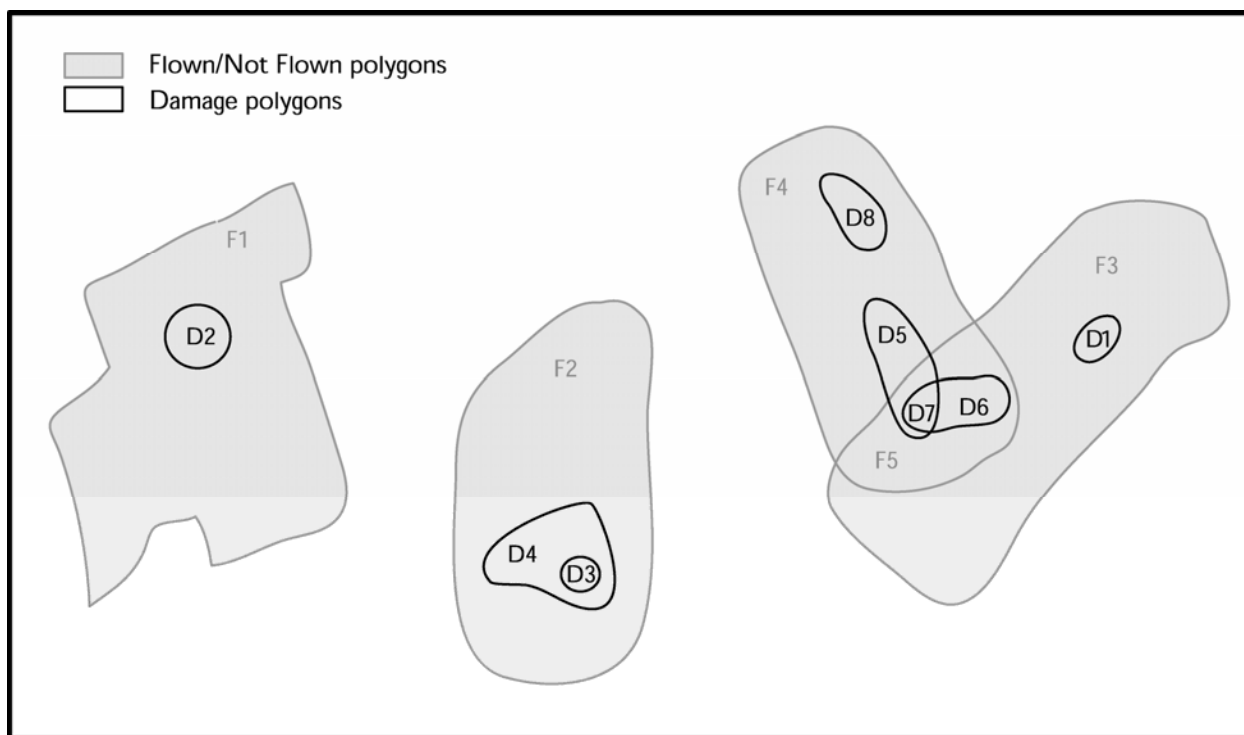
Definition (description): Notes (comments)

Format Type: Character

Format Length: 60

Appendix C Damage and Flown/Not Flown Polygon Examples

The following illustration and polygon attribute table (PAT) examples are provided to clarify various situations that occur both during a survey and while building attribute tables. Information is given for four hypothetical aerial surveys, which resulted in five flown/not flown polygons and seven damage polygons.



Damage Polygons

Polygon D1

Observation 1: Survey 2 - high severity (2) of continuous (1) defoliation (1) by western spruce budworm (12040) in Douglas-fir (202)

Observation 2: No Data

Observation 3: No Data

Polygon D2

Observation 1: Survey 7 - mortality (2) of 150 trees per acre by southern pine beetle (11003) in loblolly/shortleaf pine group (300). Number of trees is calculated from trees per acre (150) multiplied by total acres (0.6).

Observation 2: No Data

Observation 3: No Data

Polygon D3

Observation 1: Survey 7 - No damage (9) in polygon surrounded by polygon with damage

Observation 2: No Data

Observation 3: No Data

Polygon D4

Observation 1: Survey 23 - high severity(2) of continuous (1) defoliation (1) by gypsy moth (12089) in red oak (833)

Observation 2: Survey 23 - high severity(2) of continuous (1) defoliation (1) by gypsy moth (12089) in white oak (802)

Observation 3: Survey 23 - low severity(1) of patchy (2) defoliation (1) by gypsy moth (12089) in white pine (129)

The following three examples describe a situation where the combining of all surveys into one final coverage reveals an area of overlap. As a result, not all final PAT values are a direct reflection of observed attributes. The trees per acre values for polygons D5 and D6 are calculated from observed tree counts divided by acres of the original “parent” polygon. In this example, the total acres for “parent” D5 is D5acres (22.4) plus D7acres (4.4) and the total acres for “parent” D6 is D6acres (58.2) plus D7acres (4.4).

Once coverages are combined and overlap appears, trees per acre values and all attributes EXCEPT number of trees are carried over to the new polygons. Number of trees is then calculated based on acres of the newly created polygons. Therefore, number of trees observed for the parent polygon are now split between what remains of the parent polygon and the new overlap area.

Polygon D5 (parent)

Observation 1: Survey 10 - low severity (1) of continuous (1) defoliation (1) by western spruce budworm (12040) in Douglas-fir (202)

Observation 2: Survey 10 - mortality (2) of 5 trees by Ips engraver beetle (11030) in Douglas-fir (202)

Observation 3: No Data

Polygon D6 (parent)

Observation 1: Survey 2 - mortality (2) of 10 trees by Douglas-fir beetle (11007) in Douglas-fir (202)

Observation 2: No Data

Observation 3: No Data

Polygon D7

This was not observed as a distinct polygon from the air, but once the damage polygons were digitized, it appeared as a product of two overlapping polygons. It will inherit the attributes of its parent polygons EXCEPT for the number of trees, which will be calculated based on the acreage of the overlap polygon.

Observation 1 (from polygon D5): Survey 10 - low severity (1) of continuous (1) defoliation (1) by western spruce budworm (12040) in Douglas-fir (202)

Observation 2 (from polygon D5): Survey 10 - mortality (2) of 5 trees by Ips engraver beetle (11030) in Douglas-fir (202)

Observation 3 (from polygon D6): Survey 2 - mortality (2) of 10 trees by Douglas-fir beetle (11007) in Douglas-fir (202).

Polygon D8

This polygon illustrates the coding scheme for mortality on multiple hosts within a single polygon.

Observation 1: Survey 10 – mortality(2) of .5 trees per acre by pine engraver(11029) on jack pine(105). Number of trees (13) is calculated from trees per acre (.5) multiplied by total acres (26.3).

Observation 2: Survey 10 – mortality(2) of 2.5 trees per acre by pine engraver(11029) on ponderosa pine(122). Number of trees (66) is calculated from trees per acre(2.5) multiplied by total acres(26.3).

Flown/Not Flown Polygons**Polygon F1**

Survey 7 : Smith flew this southern pine beetle survey in one day, beginning and ending on September 13,1999 for the USDA Forest Service (USFS) and the South Carolina Commission of Forestry (SCCF).

Polygon F2

Survey 23 : Brown and Jefferson flew this overview survey in four days, beginning October 1 and ending October 4, 1999 for the USDA Forest Service, Durham field office (DFO).

Polygon F3

Survey 2 : Thompson flew this overview survey in three days, beginning July 6 and ending July 8, 1999 for the USDA Forest Service (USFS).

Polygon F4

Survey 10 : Ogilvy flew this overview survey in one day, beginning and ending August 10, 1999 for the Colorado State Forest Service (CSFS).

Polygon F5

This was not a distinct survey, but once the flown/not flown polygons were digitized, it appeared as a product of two overlapping survey polygons. It will inherit the attributes of its parent polygons.

Item 1 attributes (from survey 2): Thompson flew this overview survey in three days, beginning July 8 and ending July 12, 1999 for the USDA Forest Service (USFS).

Item 2 attributes (from survey 10): Ogilvy flew this overview survey in one day, beginning and ending August 10, 1999 for Colorado State Forest Service (CSFS).

PAT for Damage Polygons

Item Name	D1	D2	D3	D4	D5	D6	D7	D8
AREA	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
PERIMETER	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
COVERAGE#	x	x	x	x	x	x	x	x
COVERAGE-ID	x	x	x	x	x	x	x	x
RPT_YR	2003	2003	2003	2003	2003	2003	2003	2003
SURVEY_ID1	2	7	7	23	10	2	10	10
SURVEY_ID2	-1	-1	-1	23	10	-1	10	10
SURVEY_ID3	-1	-1	-1	23	-1	-1	2	-1
DMG_TYPE1	1	2	9	1	1	2	1	2
DMG_TYPE2	-1	-1	-1	1	2	-1	2	2
DMG_TYPE3	-1	-1	-1	1	-1	-1	2	-1
SEVERITY1	2	-1	-1	2	1	-1	1	-1
SEVERITY2	-1	-1	-1	2	-1	-1	-1	-1
SEVERITY3	-1	-1	-1	1	-1	-1	-1	-1
PATTERN1	1	-1	-1	1	2	-1	2	-1
PATTERN2	-1	-1	-1	1	-1	-1	-1	-1

PATTERN3	-1	-1	-1	2	-1	-1	-1	-1
TPA1	-1	150	-1	-1	-1	0.37	-1	0.5
TPA2	-1	-1	-1	-1	0.08	-1	0.08	2.5
TPA3	-1	-1	-1	-1	-1	-1	0.37	-1
NO_TREES1	-1	90	-1	-1	-1	8	-1	13
NO_TREES2	-1	-1	-1	-1	5	-1	0	66
NO_TREES3	-1	-1	-1	-1	-1	-1	2	-1
DCA1	12040	11003	99999	12089	12040	11007	12040	11029
DCA2	99999	99999	99999	12089	11030	99999	11030	11029
DCA3	99999	99999	99999	12089	99999	99999	11007	99999
HOST1	202	-1	-1	833	202	202	202	105
HOST2	-1	-1	-1	802	202	-1	202	122
HOST3	-1	-1	-1	129	-1	-1	202	-1
FOR_TYPE1	-1	300	-1	-1	-1	-1	-1	-1
FOR_TYPE2	-1	-1	-1	-1	-1	-1	-1	-1
FOR_TYPE3	-1	-1	-1	-1	-1	-1	-1	-1
ACRES	35.2	0.6	20.9	132.7	58.2	22.3	4.4	26.3
NOTES							overlap	

PAT for Flown/Not Flown Polygons

Item Name	Polygon F1	Polygon F2	Polygon F3	Polygon F4	Polygon F5
AREA	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
PERIMETER	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
COVERAGE#	x	x	x	x	x
COVERAGE-ID	x	x	x	x	x
RPT_YR	2003	2003	2003	2003	2003
SURVEY_ID1	7	23	2	10	2
SURVEY_ID2	7	23	-1	-1	10
SURVEY_ID3	-1	-1	-1	-1	-1
FLOWN1	1	1	1	1	1
FLOWN2	1	1	-1	-1	1
FLOWN3	-1	-1	-1	-1	-1
AGENCY1	SCCF	DFO	USFS	CSFS	USFS
AGENCY2	USFS	DFO	-1	-1	CSFS
AGENCY3	-1	-1	-1	-1	-1
SURVEYOR1	Smith	Brown	Thompson	Ogilvy	Thompson
SURVEYOR2	Smith	Jefferson	-1	-1	Ogilvy
SURVEYOR3	-1	-1	-1	-1	-1
BEGIN1	19990913	19991001	19990706	19990810	19990706
BEGIN2	19990913	19991001	-1	-1	19990810
BEGIN3	-1	-1	-1	-1	-1
END1	19990913	19991004	19990708	19990810	19990708
END2	19990913	19991004	-1	-1	19990810
END3	-1	-1	-1	-1	-1
FL_DAYS1	1	4	3	1	3
FL_DAYS2	1	4	-1	-1	1
FL_DAYS3	-1	-1	-1	-1	-1
PURPOSE1	SPB detection	Overview	Overview	Overview	Overview

PURPOSE2	SPB detection	Overview	-1	-1	Overview
PURPOSE3	-1	-1	-1	-1	-1
FL_NOTES					