Chapter 6

8-Bit Raster Images (DFR8 API)

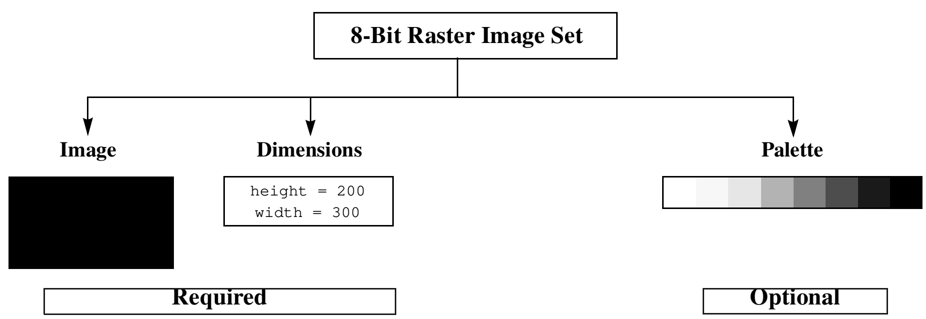
6.1 Chapter Overview

This chapter describes the 8-bit raster image data model and the single-file DFR8 interface routines. The DFR8 interface is a single-file interface that consists of routines for reading and writing raster image sets.

6.2 The 8-Bit Raster Data Model

The data model for the ***8-bit raster image*** set, or ***RIS8***, an acronym for "Raster Image Set, 8-bit", supports three types of objects; two-dimensional 8-bit raster images, dimensions and palettes. The latter two items occur once per RIS8. The following figure shows the contents of an 8-bit raster image set.

FIGURE 6a **8-Bit Raster Image Set Contents**



6.2.1 Required 8-Bit Raster Image Data Set Objects

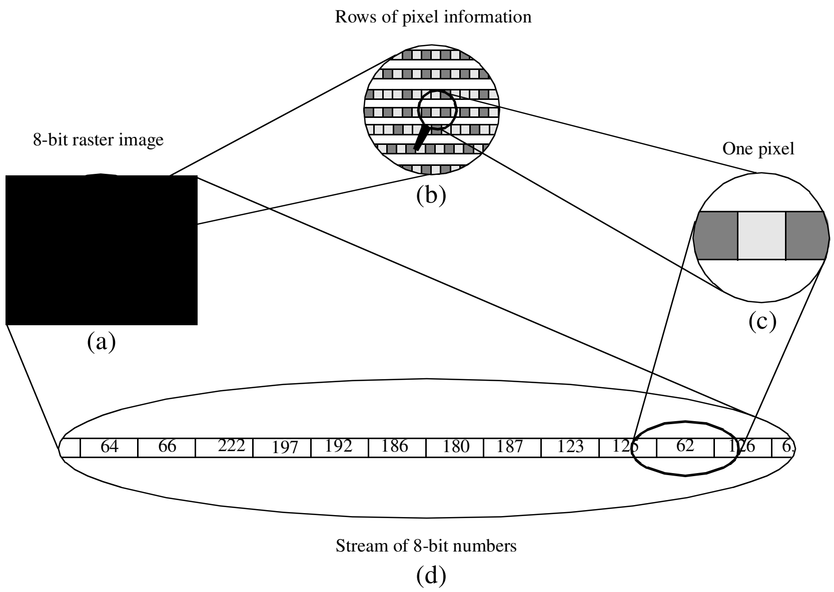
Every RIS8 object requires an image and dimension object. Required objects are created by the HDF library using information provided at the time the image is written.

6.2.1.1 8-Bit Raster Image Data Representation

An ***8-bit raster image*** is a two-dimensional array of 8-bit numbers which represent ***pixels*** or "picture elements".The first row of pixels corresponds to the top row of the image, the second row of pixels to the second row of the image and so forth. Pixel values range from 0 to 255, and indicate to the hardware which colors to use when mapping the corresponding pixels to the screen display. A ***color lookup table***, or ***palette***, provides the means of correlating pixel values to colors.

As an example, consider a stream of 8-bit numbers representing a raster image. (See Figure 6b.) When the image is displayed, the color associated with the first number in the data stream is placed in the upper left corner of the image. The remainder of the first line is then painted from left-to-right using as many values from the data stream as is necessary to complete the line. The remainder of the rows are similarly painted from left-to-right and top-to-bottom until every value in the data stream appears is represented by one pixel in the image.

FIGURE 6b **The Data Representation of an 8-Bit Raster Image**



An 8-bit raster image (a) is a set of rows displayed from left-to-right consisting of rows of pixel information (b) where each pixel (c) is represented by values stored as a single stream of 8-bit numbers (d).

6.2.1.2 8-Bit Raster Image Dimension

The ***dimensions*** of an image are its height and width in pixels.

6.2.2 Optional 8-Bit Raster Image Data Set Objects

6.2.2.1 Palettes

A ***palette*** is a lookup table consisting of 256 unique numerical values, each of which map to the 256 possible pixel color values and is stored in a RIS8 object. For more details on HDF palettes refer to Chapter 9, titled *Palettes (DFP API)*.

6.2.3 Compression Method

The compression method indicates if and how the image is compressed. It can be, at the programmer's option, explicitly set or left as its default setting of no compression. Compression schemes supported by HDF version 4.0 are ***run-length encoding*** or ***RLE***, ***joint photographic expert group compression***, or ***JPEG***, and ***image compression***, or ***IMCOMP*** . The list of compression methods is presented below. (See Table 6A.) The HDF tags `COMP_RLE`, `COMP_IMCOMP` and `COMP_JPEG` are respectively defined as the values `11`, `12` and `2` in the "hcomp.h" header file.

TABLE 6A **8-Bit Raster Image Compression Method List**

Compression Method	Type	Compression Code	Requirements
None	N/A	COMP_NONE	Image data only (default setting).
RLE	Lossless	COMP_RLE	Image data only.
JPEG	Lossy	COMP_JPEG	Image data, quality factor and compatibility factor.
IMCOMP	Lossy	COMP_IMCOMP	Image data and palette.

RLE Compression

The ***RLE*** method is a lossless compression method recommended for images where data retention is critical. The RLE algorithm compresses images by condensing strings of identical pixel values into two bytes. The first byte identifies the number of pixels in the string and the second byte records the pixel value for the string.

The amount of space saved by RLE depends upon how much repetition there is among adjacent pixels. If there is a great deal of repetition, more space is saved and if there is little repetition, the savings can be very small. In the worst case when every pixel is different from the one that precedes it an extra byte is added for every 127 bytes in the image.

JPEG Compression

The ***JPEG***, or Joint Photographic Expert Group, compression method is a lossy compression algorithm whose use is recommended for photographic or scanned images. Using JPEG compression to reduce the size of an image changes the values of the pixels and hence may alter the meaning of the corresponding data. Version 5.0 of the JPEG library is available in HDF version 4.0.

JPEG compression requires two parameters, the first the level of image quality and the second, compatibility. The ***quality factor*** determines how much of the data will be lost and thus directly impacts the size of the compressed image. A quality factor of 1 specifies the lowest quality or maximum image compression. A quality factor of 100 specifies the highest quality or minimum image compression. Note that all images compressed using the JPEG algorithm are stored in a lossy manner, even those stored with a quality factor of 100. Usually, it is best to experiment with the quality factor to find the most acceptable one.

The `baseline` parameter determines whether the contents of the quantization tables used during compression are forced into the range of 0 to 255. The `baseline` parameter is normally set to the value `1` which forces baseline results. You should set the value of the `baseline` parameter to values other than `1` *only* if you are familiar with the JPEG algorithm.

IMCOMP Compression

IMCOMP is a lossy compression method available in earlier versions of HDF. IMCOMP compression is generally of inferior quality to JPEG compression and is not recommended unless your images will be viewed on a 16-color monitor. For backward compatibility, IMCOMP compression is supported in the HDF library, For details on IMCOMP refer to Appendix F, titled *Backward Compatibility Issues*.

6.3 The 8-Bit Raster Image Interface

The HDF library contains routines for reading and writing 8-bit raster image sets. The functions **DFR8addimage**, **DFR8putimage** and **DFR8getimage** are sufficient for most reading and writing operations.

6.3.1 8-Bit Raster Image Library Routines

The names of all C functions in the 8-bit raster image interface are prefaced by "DFR8" and the names of the equivalent Fortran-77 functions are prefaced by "d8". These routines are divided into the following categories:

- ***Write routines*** create raster image sets and store them in new files or append them to existing files.
- ***Read routines*** determine the dimensions and palette assignment for an image set, read the actual image data and provide sequential or random read access to any raster image set.

The DFR8 function calls are further defined in Table 6B and in the *HDF Reference Guide*.

TABLE 6B **DFR8 Library Routines**

Category	Routine Name		Description
	C	Fortran-77	
Write	DFR8writeref	d8wref	Stores the raster image using the specified reference number.
	DFR8setpalette	d8spal	Sets palette for multiple 8-bit raster images.
	DFR8addimage	d8aimg	Appends an 8-bit raster image to a file.
	DFR8putimage	d8pimg	Writes an 8-bit raster image to an existing file or creates the file.
	DFR8setcompress	d8setcomp	Sets the compression type.
	None	d8sjpeg	Passes the quality and compatibility factors needed for the JPEG compression algorithm.
Read	DFR8getdims	d8gdims	Retrieves dimensions for an 8-bit raster image.
	DFR8getimage	d8gimg	Retrieves an 8-bit raster image and its palette.
	DFR8readref	d8rref	Gets the next raster image with the specified reference number.
	DFR8restart	d8first	Ignores information about last file accessed and restarts from beginning.
	DFR8nimages	d8nims	Returns number of raster images in a file.
	DFR8lastref	d8lref	Returns reference number of the last element accessed.
	DFR8getpalref	None	Returns the reference number of the palette associated with the last image accessed.

6.4 Writing 8-Bit Raster Images

The DFR8 programming model for writing an 8-bit raster image sets is as follows:

1. Set the compression type if the image is to be compressed. (optional)

2. Identify the palette if one is to be stored with the image. (optional)
3. Write the raster data to the file.

The two optional steps can be invoked in any order, as long as they are executed before Step 3. By default, images are stored uncompressed with no associated palette.

6.4.1 Storing a Raster Image: DFR8putimage and DFR8addimage

To write a raster image to an HDF file, the calling program must contain the following:

C: `status = DFR8putimage(filename, image, width, height, compress);`

FORTRAN: `status = d8pimg(filename, image, width, height, compress)`

OR

C: `status = DFR8addimage(filename, image, width, height, compress);`

FORTRAN: `status = d8aimg(filename, image, width, height, compress)`

DFR8putimage and **DFR8addimage** write an 8-bit raster image to an HDF file named by the `filename` parameter. When given a new filename, **DFR8putimage** and **DFR8addimage** create a new file and write the raster image as the first raster image in the file. When given an existing filename, **DFR8putimage** overwrites the file whereas **DFR8addimage** appends data to the end of the file.

In the **DFR8putimage** and **DFR8addimage** functions, the raster data is passed in the `image` parameter and the width and height of the image are passed in the `width` and `height` parameters. The compression algorithm used to store the image is passed in the compress parameter. Valid compress values include `COMP_NONE`, `COMP_RLE`, `COMP_JPEG` and `COMP_IMCOMP`. `COMP_NONE` represents no compression (storage only), `COMP_RLE` represents run-length encoding, `COMP_JPEG` represents JPEG compression and `COMP_IMCOMP` represents IMCOMP encoding.

Parameters for **DFR8putimage** and **DFR8addimage** are further described below. (See Table 6C on page 173.)

TABLE 6C **DFR8putimage and DFR8addimage Parameter List**

Routine Name (Fortran-77)	Parameter	Data Type: C	Data Type: Fortran-77	Description
DFR8putimage (d8pimg) and DFR8addimage (d8aimg)	filename	char *	character* (*)	Name of file the raster image will be stored in.
	image	VOIDP	<valid numeric data type>	Image data array.
	width	int32	integer	Number of columns in the raster image.
	height	int32	integer	Number of rows in the raster image.
	compress	int16	integer	Compression type.

EXAMPLE 1. **Writing an 8-Bit Raster Image to an HDF File**

In the following code examples, **DFR8addimage** and **d8aimg** are used to write an 8-bit image to a file named "Example1.hdf". Note that the order in which the dimensions for the image array are declared differs between C and Fortran-77.

C:

```
#include "hdf.h"
```

```
#define WIDTH 5
#define HEIGHT 6

main( )
{

/* Initialize the image array */
static uint8 raster_data[HEIGHT][WIDTH] =
    { 1, 2, 3, 4, 5,
    6, 7,8, 9, 10,
    11, 12, 13,14, 15,
    16, 17, 18, 19, 20,
    21, 22, 23,24, 25,
    26, 27, 28,29, 30 };

intn status;


/* Write the 8-bit raster image to file */
status = DFR8addimage("Example1.hdf", raster_data,
                WIDTH, HEIGHT, 0);

}
```

FORTRAN:

```
     PROGRAM RASTER8

      character*1 raster_data(5,6)
      integer retn, d8aimg

      integer*4 WIDTH, HEIGHT
      parameter(WIDTH = 5, HEIGHT = 6)

C     Initialize the image array
      data raster_data /  1,  2,  3,  4,  5,
     $                    6,  7,  8,  9, 10,
     $                   11, 12, 13, 14, 15,
     $                   16, 17, 18, 19, 20,
     $                   21, 22, 23, 24, 25,
     $                   26, 27, 28, 29, 30 /

C     Write the 8-bit raster image to the file
      retn = d8aimg('Example1.hdf', raster_data, WIDTH, HEIGHT, 0)

      end
```

6.4.2 Adding a Palette to an RIS8 Object: DFR8setpalette

DFR8setpalette identifies the palette to be used for the subsequent write operations. It may be used to assign a palette to a single image or several images. After a palette has been set, it acts as the current palette until it is replaced by another call to **DFR8setpalette**. To create a raster image set containing a palette, the calling program must contain the following:

C:

```
status = DFR8setpalette(palette);
status = DFR8addimage(filename, image, width, height, compress);
```

FORTRAN:

```
status = d8spal(palette)
status = d8aimg(filename, image, width, height, compress)
```

DFR8setpalette takes `palette` as its only parameter. To set the default palette to “no palette”, pass `NULL` as the `palette` parameter. **DFR8setpalette** is further defined in the following table.

TABLE 6D

DFR8setpalette Parameter List

Routine Name (Fortran-77)	Parameter	Data Type		Description
		C	Fortran-77	
DFR8setpalette (d8spal)	palette	uint8 *	character* (*)	Palette to be assigned.

EXAMPLE 2.

Writing a Palette and an Image in RIS8 Format

These examples demonstrate how a palette stored in the array `colors` and the raw image stored in the 20 x 20 array `picture` is written to a RIS8 object. The image is not compressed and, in these examples, uninitialized. The raster image set is stored as the first image in "Example2.hdf". Note that because **DFR8putimage** recreates the file, anything previously contained in this file will be erased.

C:

```
#include "hdf.h"

#define WIDTH 20
#define HEIGHT 20

main( )
{
uint8 colors[256*3], picture[HEIGHT][WIDTH];
uint8 i, j;
int16 status;

/* Initialize image arrays. */
for (j = 0; j < WIDTH; j++) {
    for (i = 0; i < HEIGHT; i++)
        picture[j][i] = 1;
      }

/* Set the current palette. */
status = DFR8setpalette(colors);

/* Write the image data to the file. */
status = DFR8putimage("Example2.hdf", picture, WIDTH,
                HEIGHT, COMP_NONE);

}
```

FORTRAN:

```
     PROGRAM WRITE UNCOMPRESSED RIS8

      integer   d8spal, d8pimg, status, i, j
      integer   colors(768)
      integer*4   WIDTH, HEIGHT, COMP_NONE
      parameter (COMP_NONE = 0,
     +           WIDTH = 20,
     +           HEIGHT = 20)
      integer   picture(WIDTH, HEIGHT)

C     Initialize the image data.
      do 20 j = 1, WIDTH
```

```
          do 10 i = 1, HEIGHT
             picture(j, i) = 1
10        continue
20      continue

C       Set the current palette.
        status = d8spal(colors)

C       Write the image data to the file.
        status = d8pimg('Example2.hdf', picture, WIDTH, HEIGHT,
     +                 COMP_NONE)

        end
```

6.4.3 Compressing 8-Bit Raster Image Data: DFR8setcompress

The compression type is determined by the tag passed as the fifth argument in calls to the **DFR8putimage** and **DFR8addimage** routines. **DFR8setcompress** is currently required only to reset the default JPEG compression options. However, future versions of this routine will support additional compression schemes.

To set non-default compression parameters, the calling program should contain the following sequence of routines:

C:
```
status = DFR8setcompress(type, c_info);
status = DFR8addimage(filename, image, width, height, compress);
```

FORTRAN:
```
status = d8scomp(type)
<compression-specific code>
status = d8aimg(filename, image, width, height, compress)
```

Notice that the calling sequence for C differs from the calling sequence for Fortran-77. Once the compression is set, the parameter `type` in the **DFR8setcompress** routine, or **d8scomp** in Fortran-77, specifies the compression method that will be used when storing the raster images. However, the `c_info` parameter, which is a pointer to a structure that contains information specific to the compression scheme indicated by the `type` parameter in **DFR8setcompress**, is missing from **d8scomp**. Because data structures of variable size are not supported in Fortran-77, another routine specific to the compression library is required in the Fortran-77 calling sequence.

The `c_info` union is described in Chapter 3, titled *Scientific Data Sets (SD API)*. The values contained in this union are passed into the **d8sjpeg** Fortran-77-specific routine.

Parameters for **DFR8setcompress** and **d8sjpeg** are further described in Table 6E below.

TABLE 6E **DFR8setcompress Parameter List**

Routine Name (Fortran-77)	Parameter	Data Type		Description
		C	Fortran-77	
DFR8setcompress (d8scomp)	type	int32	integer	Compression method.
	c_info	comp_info *	None	Pointer to JPEG information structure.
d8sjpeg	quality	none	integer	JPEG quality factor.
	baseline	none	integer	JPEG baseline.

EXAMPLE 3.

Writing a Set of Compressed 8-Bit Raster Images

These examples contain a series of calls in which four 20 x 20 images are written to the same file. The first two use palette `paletteA` and are compressed using the RLE method; the third and fourth use palette `paletteB` and are not compressed.

C:

```
#include "hdf.h"

#define WIDTH 20
#define HEIGHT 20

main ( )
{
uint8 paletteA[256*3], paletteB[256*3];
uint8 picture1[HEIGHT][WIDTH], picture2[HEIGHT][WIDTH];
uint8 picture3[HEIGHT][WIDTH], picture4[HEIGHT][WIDTH];
uint8 i, j;
int16 status;

/* Initialize image arrays. */
for (j = 0; j < WIDTH; j++) {
    for (i = 0; i < HEIGHT; i++) {
        picture1[j][i] = 1;
        picture2[j][i] = 1;
        picture3[j][i] = 1;
        picture4[j][i] = 1;
    }
}

/* Set the first palette. */
status = DFR8setpalette(paletteA);

/* Write the compressed image data to the HDF file. */
status = DFR8putimage("Example3.hdf", (VOIDP)picture1, WIDTH, HEIGHT, \
                COMP_RLE);
status = DFR8addimage("Example3.hdf", (VOIDP)picture2, WIDTH, HEIGHT, \
                COMP_RLE);

/* Set the second palette. */
status = DFR8setpalette(paletteB);

/* Write the uncompressed image data to the HDF file. */
status = DFR8addimage("Example3.hdf", (VOIDP)picture3, WIDTH, HEIGHT, \
                COMP_NONE);
status = DFR8addimage("Example3.hdf", (VOIDP)picture4, WIDTH, HEIGHT, \
                COMP_NONE);

}
```

FORTRAN:

```
      PROGRAM WRITE IMAGE SETS

        integer d8spal, d8pimg, d8aimg, status
        integer*4 COMP_RLE, COMP_NONE, WIDTH, HEIGHT
        parameter (COMP_RLE = 11,
     +            COMP_NONE = 0,
     +            WIDTH = 20,
     +            HEIGHT = 20)
```

```
      integer paletteA(768), paletteB(768)
      integer picture1(WIDTH, HEIGHT), picture2(WIDTH, HEIGHT)
      integer picture3(WIDTH, HEIGHT), picture4(WIDTH, HEIGHT)

C     Initialize the image data.
      do 20 j = 1, WIDTH
       do 10 i = 1, HEIGHT
        picture1(j, i) = 1
        picture2(j, i) = 1
        picture3(j, i) = 1
        picture4(j, i) = 1
10     continue
20    continue

C     Set the first palette.
      status = d8spal(paletteA)

C     Write the compressed image data to the HDF file.
      status = d8pimg('Example3.hdf', picture1, WIDTH, HEIGHT,
     +               COMP_RLE)
      status = d8aimg('Example3.hdf', picture2, WIDTH, HEIGHT,
     +               COMP_RLE)

C     Set the second palette.
      status = d8spal(paletteB)

C     Write the uncompressed image data to the HDF file.
      status = d8aimg('Example3.hdf', picture3, WIDTH, HEIGHT,
     +               COMP_NONE)
      status = d8aimg('Example3.hdf', picture4, WIDTH, HEIGHT,
     +               COMP_NONE)

      end
```

EXAMPLE 4.

Compressing and Writing a 8-Bit Raster Image

In the following examples, **DFR8addimage** and **DFR8compress** are used to compress an 8-bit image and write it to an HDF file named "Example2.hdf". Notice that compressing an image in C requires only one function call, whereas compressing an image using Fortran-77 requires two. The second Fortran-77 call is required because it is not valid to pass a structure as a parameter in Fortran-77.

C:

```
#include "hdf.h"
#include "hcomp.h"

#define WIDTH 3
#define HEIGHT 5
#define PIXEL_DEPTH 3

main( )
{
/* Initialize the image array. */
static uint8 raster_data[HEIGHT][WIDTH][PIXEL_DEPTH] =
    {  1, 2, 3,   4, 5, 6,   7, 8, 9,
      10,11,12, 13,14,15, 16,17,18,
      19,20,21, 22,23,24, 25,26,27,
      28,29,30, 31,32,33, 34,35,36,
      37,38,39, 40,41,42, 43,44,45 };
```

```
static comp_info compress_info;
intn status;

/* Initialize JPEG compression structure. */
compress_info.jpeg.quality = 60;
compress_info.jpeg.force_baseline = 1;

/* Set JPEG compression for storing the image. */
status = DFR8setcompress(COMP_JPEG, &compress_info);

/* Write the 8-bit image data to file. */
status = DFR8addimage("Example2.hdf", (VOIDP)raster_data, WIDTH,
                          HEIGHT, COMP_JPEG);

}
```

FORTRAN:

```
     PROGRAM COMPRESS RIS8

      integer d8aimg, d8scomp, d8sjpeg, status
      integer*4 WIDTH, HEIGHT, PIXEL_DEPTH, COMP_JPEG

C     COMP_JPEG is defined in hcomp.h.
      parameter(WIDTH = 3,
     +          HEIGHT = 5,
     +          COMP_JPEG = 1,
     +          PIXEL_DEPTH = 3)
      character raster_data(PIXEL_DEPTH, WIDTH, HEIGHT)

C     Initialize the image array.
      data raster_data
     + /  1, 2, 3,  4, 5, 6,  7, 8, 9,
     +    10,11,12, 13,14,15, 16,17,18,
     +    19,20,21, 22,23,24, 25,26,27,
     +    28,29,30, 31,32,33, 34,35,36,
     +    37,38,39, 40,41,42, 43,44,45  /

C     Set compression.
      status = d8scomp(COMP_JPEG)

C     Set JPEG parameters to quality = 60, and turn compatibility on.
      status = d8sjpeg(60, 1)

C     Write the 8-bit image data to the HDF file.
      status = d8aimg('Example2.hdf', raster_data, WIDTH, HEIGHT,
     +              COMP_JPEG)

      end
```

6.4.4 Specifying the Reference Number of an RIS8: DFR8writeref

DFR8writeref specifies the reference number of the image to be written when **DFR8addimage** or **DFR8putimage** is called. Use the following calling sequence to invoke **DFR8writeref**:

C:

```
status = DFR8writeref(filename, ref);
status = DFR8addimage(filename, image, width, height, compress);
```

FORTRAN:

```
status = d8wref(filename, ref)
status = d8aimg(filename, image, width, height, compress)
```

DFR8writeref assigns the reference number passed in the `ref` parameter to the next image the file specified by the `filename` parameter. If the value of `ref` is the same as the reference number of an existing RIS8, the existing raster image data will be overwritten. The parameters for **DFR8writeref** are further described below. (See Table 6F.)

It is unlikely that you will need this routine, but if you do, use it with caution. It is not safe to assume that a reference number indicates the file position of the corresponding image as there is no guarantee that reference numbers appear in sequence in an HDF file.

TABLE 6F **DFR8writeref Parameter List**

Routine Name (Fortran-77)	Parameter	Data Type		Description
		C	Fortran-77	
DFR8writeref (**d8wref**)	filename	char *	character* (*)	Name of the HDF file containing the raster image.
	ref	uint16	integer	Reference number for next call to **DFR8getimage**.

6.5 Reading 8-Bit Raster Images

The DFR8 programming model for reading an 8-bit raster image set is as follows:

1. Determine the dimensions of the image if they are not known prior to the read operation.
2. Read the image from the file.

6.5.1 Reading a Raster Image: DFR8getimage

If dimensions of the image are known, **DFR8getimage** is the only function call needed to read a raster image. If a file is being opened for the first time, **DFR8getimage** returns the first image in the file. Additional calls will return successive images in the file, therefore images are read in the order which they were written to the file. **DFR8getdims** is called before **DFR8getimage** so that space allocations for the image and palette can be checked and the dimensions verified. If this information is already known, **DFR8getdims** may be omitted.

To read a raster image from an HDF file, the calling program must contain the following:

C:
```
status = DFR8getimage(filename, image, width, height, palette);
```

FORTRAN:
```
status = d8gimg(filename, image, width, height, palette)
```

DFR8getimage retrieves the next 8-bit image from the HDF file name specified by the `filename` parameter. If the image in the file is compressed, **DFR8getimage** first decompresses it then places it in memory at the location pointed to by the `image` parameter. The dimensions of the array allocated to hold the image are specified by the `width` and `height` parameters and may be larger than the actual image.The palette, if present, is stored in memory at the location pointed to by the `palette` parameter. If it contains a `NULL` value the palette is not loaded, even if there is one stored with the image. The parameters for **DFR8getimage** are defined further in Table 6G below.

Notice that in Example 4, as in the case of **DFR8addimage**, the order in which the dimensions for the `image` array are declared differs between C and Fortran-77. Fortran-77 declarations require the width before the height while the C declaration requires the height before the width as Fortran-77 arrays are stored in column-major order, while C arrays are stored in row-major order. (row-major order implies that the second coordinate varies fastest). When **d8gimg** reads an image from a file, it assumes column-major order.

6.5.2 Querying the Dimensions of an 8-Bit Raster Image: DFR8getdims

DFR8getdims opens a named file, finds the next image or the first image if the file is being opened for the first time, retrieves the dimensions of the image and determines if there is a palette associated with the image. If the file is being opened for the first time, **DFR8getdims** returns information about the first image in the file. If an image has already been read, **DFR8getdims** finds the next image. In this way, images are read in the same order in which they were written to the file.

To determine the dimensions of an image before attempting to read it, the calling program must include the following routines:

C:
```
status = DFR8getdims(filename, width, height, haspalette);
status = DFR8getimage(filename, image, width, height, palette);
```

FORTRAN:
```
status = d8gdim(filename, width, height, haspalette)
status = d8gimg(filename, image, width, height, palette)
```

DFR8getdims retrieves dimension and palette information about the next 8-bit image in the file specified by `filename`. The returned information is pointed to by the `width` and `height` parameters. The `haspalette` parameter determines the presence of a palette and returns a value of `1` if it exists and `0` otherwise. The parameters for **DFR8getdims** are defined further in the following table.

TABLE 6G

DFR8getdims and DFR8getimage Parameter List

Routine Name (Fortran-77)	Parameter	Data Type		Description
		C	Fortran-77	
DFR8getdims (d8gdims)	filename	char *	character* (*)	Name of the HDF file containing the set of raster images.
	width	int32 *	integer	Number of columns in the next raster image.
	height	int32 *	integer	Number of rows in the next raster image.
	ispalette	intn *	integer	“1” if a palette exists, otherwise “0”.
DFR8getimage (d8gimg)	filename	char *	character* (*)	Name of HDF file with the raster image.
	image	uint8 *	character* (*)	Buffer for the raster image.
	width	int32	integer	Width of the raster image buffer.
	height	int32	integer	Height of the raster image buffer.
	palette	uint8 *	character* (*)	Palette assigned to the raster image.

EXAMPLE 5.

Reading an 8-Bit Raster Image

The following examples search the "Example1.hdf" file created in Example1 for the dimensions of an 8-bit image. Although the **DFR8getdims** call is optional, it is included as a demonstration of how to check the dimensions of an image. This example also assumes that the data set does not include a palette, therefore `NULL` is passed as the palette parameter. If the palette argument is `NULL` (or "0" in Fortran-77), all palette data is ignored.

C:
```
#include "hdf.h"
```

```
#define WIDTH 5
#define HEIGHT 6

main( )
{
uint8 raster_data[HEIGHT][WIDTH];
int32 width, height;
intn haspal, status;

/* Get the dimensions of the image */
status = DFR8getdims("Example1.hdf", &width, &height, &haspal);

/* Read the raster data if the dimensions are correct */
if (width <= WIDTH && height <= HEIGHT)
    status = DFR8getimage("Example1.hdf", (VOIDP)raster_data, width,
                height, NULL);

}
```

FORTRAN:

```
     PROGRAM RASTER8

      character*1 image(5, 6)
      integer status, height, width, d8gimg, d8gdims, haspal
      integer*4 width, height

C     Get the dimensions of the image.
      status = d8gdims('Example1.hdf', width, height, haspal)

C     Read the raster data if the dimensions are correct.
      if (width .le. 5 .and. height .le. 6) then
         status = d8gimg('Example1.hdf', image, width, height, 0)
      endif

      end
```

6.5.3 Reading an Image with a Given Reference Number: DFR8readref

DFR8readref accesses specific images that are stored in files containing multiple raster image sets. It is an optionally used before **DFR8getimage** to set the access pointer to the specified raster image. **DFR8readref** can be used in connection with vgroups, which identify their members by tag/reference number pairs. See Chapter 5, titled *Vgroups (V API)*, for a discussion of vgroups and tag/reference number pairs.

To access a specific raster image set, use the following calling sequence:

C:

```
status = DFR8readref(filename, ref);
status = DFR8getimage(filename, image, width, height, palette);
```

FORTRAN:

```
status = d8rref(filename, ref)
status = d8gimg(filename, image, width, height, palette)
```

DFR8readref specifies that the target for the next read operation performed on the HDF file specified by the `filename` parameter is the object with the reference number named in the `ref` parameter. The parameters required for **DFR8readref** are defined further in the following table.

TABLE 6H

DFR8readref Parameter List

Routine Name (Fortran-77)	Parameter	Data Type		Description
		C	Fortran-77	
DFR8readref (d8rref)	filename	char *	character* (*)	Name of HDF file containing the raster image.
	ref	uint16	integer	Reference number for next call to **DFR8getimage**.

6.5.4 Specifying the Next 8-Bit Raster Image to be Read: DFR8restart

DFR8restart causes the next call to **DFR8getimage** or **DFR8getdims** to read the first raster image set in the file. Use the following call to invoke **DFR8restart**:

C:
```
status = DFR8restart( );
```

FORTRAN:
```
status = d8first( )
```

6.6 8-Bit Raster Image Information Retrieval Routines

6.6.1 Querying the Total Number of 8-Bit Raster Images: DFR8nimages

DFR8nimages returns the total number of 8-bit raster image sets in a file and has the following syntax:

C:
```
num_of_images = DFR8nimages(filename);
```

FORTRAN:
```
num_of_images = d8nimg(filename)
```

TABLE 6I

DFR8nimages Parameter List

Routine Name (Fortran-77)	Parameter	Data Type		Description
		C	Fortran-77	
DFR8nimages (d8nims)	filename	char *	character* (*)	Name of the HDF file.

6.6.2 Determining the Reference Number of the Most-Recently-Accessed 8-Bit Raster Image: DFR8lastref

DFR8lastref returns the reference number most recently used in writing or reading an 8-bit raster image. This routine is primarily used for attaching annotations to images and adding images to vgroups. (See Chapters 8, titled *Annotations (DFAN API)* and Chapter 5, titled *Vgroups (V API)* for more detailed information on how to use reference numbers in connection with these applications.)

The following calling sequence uses **DFR8lastref** to find the reference number of the 8-bit raster image most recently added to an HDF file:

C:
```
status = DFR8addimage(filename, image, width, height, compress);
lastref = DFR8lastref( );
```

FORTRAN:
```
status = d8aimg(filename, image, width, height, compress)
lastref = d8lref( )
```

DFR8putimage or **DFR8getimage** can be used instead of **DFR8addimage** with similar results.

6.6.3 Determining the Reference Number of the Palette of the Most-Recently-Accessed 8-Bit Raster Image: DFR8getpalref

DFR8getpalref returns the reference number of the palette associated with the most recently used in writing or reading an 8-bit raster image. The **DFR8getdims** routine must be called before **DFR8getpalref**, as **DFR8getdims** initializes internal structures required by **DFR8getpalref**.

There is currently no Fortran-77 version of the **DFR8getpalref** routine.

TABLE 6J **DFR8nimages Parameter List**

Routine Name (Fortran-77)	Parameter	Data Type		Description
		C	Fortran-77	
DFR8getpalref	pal_ref	uint16 *	None	Pointer to the returned reference number of the palette.

6.7 RIS8 Backward Compatability Issues

6.7.1 Attribute "long_name" Included in HDF for netCDF Compatibility

In several routines of the RIS8 interface, the value returned by `label` is the value of the attribute named "long_name" and that the value returned by `coordsys` is the value of the attribute named "cordsys".

This was done in order to provide HDF with the ability to read netCDF files. While this aspect of HDF functionality will not affect its ability to read HDF data files written by programs compiled with earlier versions of HDF, it is advisable for HDF users to know this to be aware of the significance of the "long_name" and "cordsys" attribute names in a list of attributes.

6.7.2 Raster Image Group Implementation with New RIS8 Tags

As HDF has evolved, a variety of structures have been used to store raster image sets. For instance, HDF first began grouping 8-bit raster images together with dimensions and palettes by insuring that their reference numbers fell in a certain pattern. This method of organizing raster images quickly lead to very complicated collections of images, dimension records, and palettes, and eventually was replaced by an specific grouping structure known as a ***Raster Image Group****,* or ***RIG***, with a completely new set of tags.

To maintain backward compatibility with older versions of HDF, the RIS8 interface supported by HDF version 4.1 and later recognizes raster images stored using either set of HDF tags. Details on the different tags and structures used to store raster images can be found in the *HDF Specification Manual*, versions 3.2 or later.