IRRIGATED ACREAGE IN THE BEAR RIVER BASIN AS OF THE 1975 GROWING SEASON

CRSC Report 82-3

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Sioux Falls, SD 57198

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ABSTRACT

The irrigated cropland in the Bear River Basin as of the 1975 growing season has been inventoried from satellite imagery. Landsat color infrared images (scale 1:125,000) were examined for early, mid, and late summer dates, and acreage was estimated by use of township/section overlays. The total basin acreage was estimated to be 573,435 acres, with individual state totals as follows: Idaho 234,370 acres; Utah 265,505 acres; and Wyoming 73,560 acres. As anticipated, wetland areas intermingled among cropland appears to have produced an over-estimation of irrigated acreage. According to a 2% random sample of test sites evaluated by personnel from the Soil Conservation Service such basin-wide over-estimation is 7.5%; individual counties deviate significantly from the basin-wide figure, depending on the relative amount of wetland areas intermingled with cropland.

ACKNOWLEDGMENTS

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A number of federal and state administrative agency personnel have greatly assisted in the completion of this investigation. Thanks is extended to Hal Anderson of the Idaho Department of Water Resources, and Ed Harne, Bureau of Land Management for allowing the use of color infrared photography for Idaho, and Rich County, Utah, respectively. The following officers and personnel of the Soil Conservation Service provided valuable input in terms of delineating irrigated cropland, verification of irrigated areas, and information regarding local dryland farming practices:

<u>Idaho</u>

Oneida County	John Grubb, District Conservationist ("D.C.") John Kendrick, Technician
Franklin County	DeWane Downs, D.C. Glade Moser, Technician
Caribou County	Tom Kellner, D.C.
Bear Lake County	Mike Marshall, D.C. Lori Pachecko, Technician

<u>Utah</u>

Box Elder County	Merrill Johnson, D.C.
Cache County	Duane Erickson, D.C. Sherman Lewis, Technician
Rich County	Keith Lemmon, Technician Fred Nielson, Soils Scientist

<u>Wyoming</u>

Lincoln County	Damont Grandy, D.C. Jack Harmon, Technician
Uinta County	Dan Fosher, D.C. Don Lewis, Technician

INTRODUCTION

The Amended Bear River Compact, ratified in 1979 by the U.S. Senate (Senate Bill S-1489), decreed that water rights applied to beneficial use prior to January 1, 1976 in the Bear River Basin (Figure 1) portions of Idaho, Utah, and Wyoming would be protected. The compact also allocated the rights of the participating states to the use of water in excess of the water applied for beneficial use prior to January 1, 1976. This structure of the compact created the need to inventory the amount of cropland receiving irrigation during the 1975 growing season. Such an inventory would provide a basis for estimating the amount of water applied to beneficial use in 1975, as well as serve as a basis for monitoring additional land being brought into irrigation subsequent to the 1975 season.

It follows that remotely sensed information provides the only objective source of data from which irrigated acreage for such a large area can be approximated for a past point in time. Remote sensing, or the process of analyzing objects from a distance, applies in the case of irrigated cropland to any light detecting and recording device which is elevated above the surface of the earth. Basically, there are three reasonable approaches to the inventory of irrigated cropland in 1975 by studying recorded solar reflection characteristics of the earth: visual interpretation of aerial photography (black and white, natural color, or preferable color infrared); visual interpretation of satellite imagery; or digital interpretation of satellite data. To objectively utilize photography would require uniform coverage over the entire basin for the target date or season. While there is some black and white photography and some color infrared photography over parts of the basin for 1975, large areas remain without coverage for that season. Another problem encountered with an inventory based entirely on aerial photography is

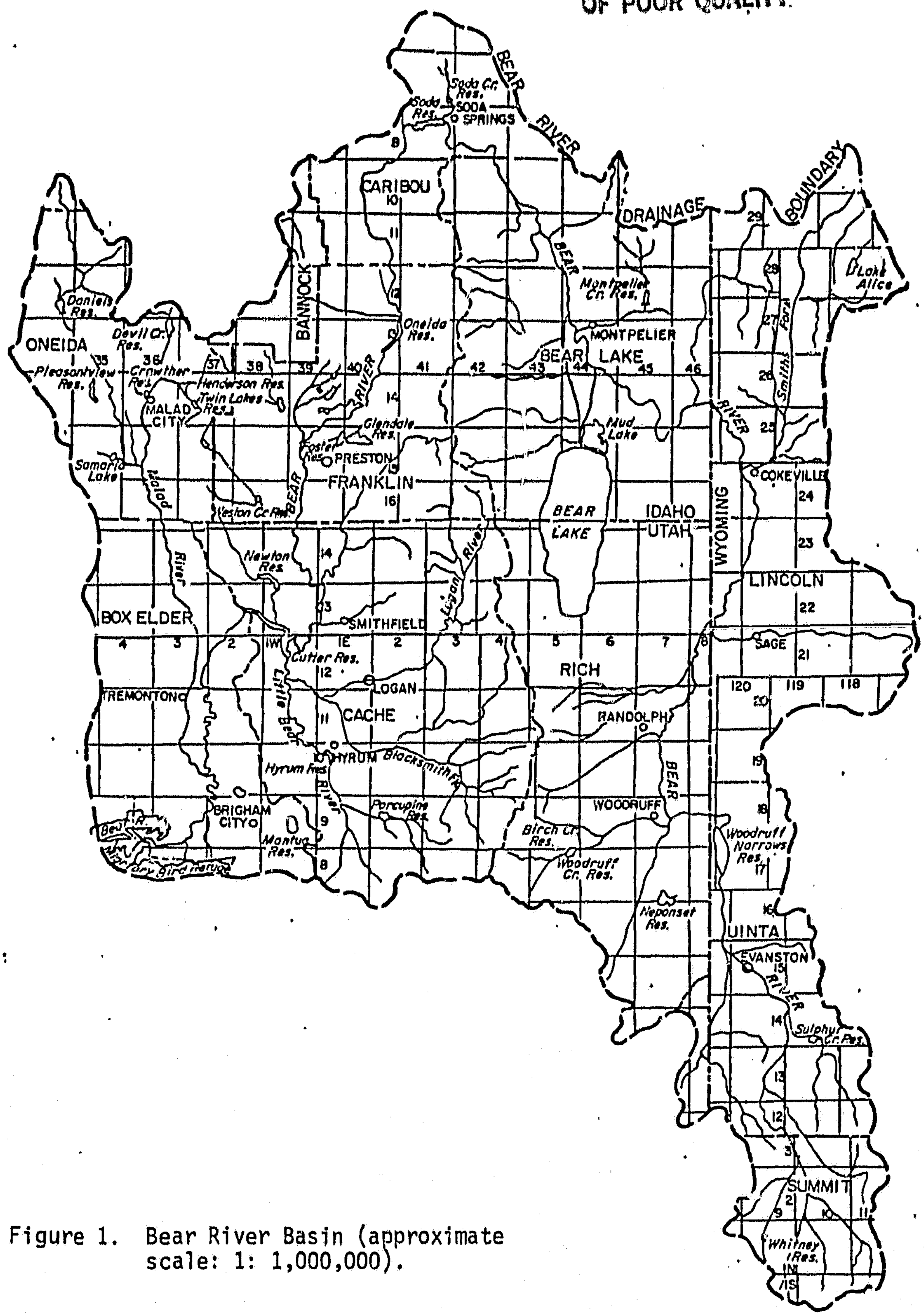

Figure 1. Bear River Basin (approximate scale: 1: 1,000,000).

that such photography, where available, only provides a single date for the estimation of irrigated acreages. It remains for the Landsat satellite to provide the only uniform data available over the entire basin for multiple dates in specified season. During the 1975 season, both Landsats 1 and 2 were in operation, on approximately a 9-day return interval. Since budget constraints of this project precluded digital analysis of Landsat data, the interpretation of Landsat photo-images was chosen as the best compromise for obtaining the 1975 inventory.

It may be helpful to provide a brief explanation as to the nature of the data which is used to prepare Landsat images. Each frame or "scene" of satellite data represents a huge matrix of individual cells called picture elements or "pixels", for which solar radiation reflectance values have been recorded by an electronic sensor: the multi-spectral scanner (MSS). As the MSS scans across the 115 mile by 115 mile scene area, it records brightness values in four spectral bands from each pixel. The MSS has a ground resolution of approximately 1.1 acre; the combined light reflecting properties of the land cover and terrain features contained within each pixel are recorded. Reflectance values for the two visable (green and red) light bands and two invisible (near infrared) bands are then electronically relayed to earth receiving stations. The photographic Landsat products, called images inasmuch as they are not derived directly from typical camera and film processes, are produced by passing any three of the bands through color filters and onto color film. In this study, one of the infrared bands has been made visable by use of a red filter, and the red and green bands have been passed through green and blue filters, respectively. The result is a "false" color composite, which presents healthy green vegetation, which has infrared light high reflectance, as bright red. Clear and deep water bodies appear as dark blue or black, and poorly vegetated areas or areas with dormant or dead vegetation have light tones. Urban areas are typically blue-grey.

METHODOLOGY

Landsat Data Selection

Inasmuch as the objective was to inventory all of the irrigated land in the basin, field-by-field, as distinct from a sampling approach, it was necessary to obtain imagery coverage of the entire basin. In addition, since a given field may appear dormant during a part of the growing season (as in the case of alfalfa stubble following a first or second cutting) it was necessary to obtain imagery at more than one date during the growing season. Furthermore, some fields may be irrigated early, and others not until late in the season. From previous studies (*) it was shown that these dates, carefully chosen with regard to crop phenology, would be sufficient to show whether a given field was irrigated at any time during the growing season. Date selection also had to account for variation in growing season from low elevation fields in the southwest part of the basin, to high elevation valleys to the north and east. It was judged that the best combination of dates would be early June, early July, and early August.

Landsat system constraints affecting the selection of data include frequency of overpass, spectral quality of the data generated, cloud cover, and specific area of coverage of individual scenes or frames. Landsat 2 quality typically exceeds Landsat 1. No single frame was large enough to

* CRSC has demonstrated the utility of this technique in a study of irrigated land in southern Utah (Ridd and Harmon, 1979). In that and a subsequent study (Ridd, et al., 1981) it was shown that a single date is inadequate to determine active irrigated acreage for the season, especially for crops with intraseasonal cycles of production, such as alfalfa. At least two, and preferably three dates should be carefully selected through the growing season.

cover the entire basin. The "main scene" (path 41 row 31) covered most of the basin, with a second scene (41-30) to encompass the northern part of the basin, a third scene (40-31) to provide additional coverage in the eastern area, and a fourth scene (40-30) to cover Summit County, Utah.

Given the above objectives and constraints, the following scenes and dates were selected:

Path-Row	Dates
41-31	30 May 1975, 14 July 1975, 10 August 1975
41-30	30 May 1975, 14 July 1975, 10 August 1975
40-31	9 August 1975
40-30	18 August 1975

The earlier studies mentioned in the footnote above, also showed specially enlarged Landsat color images at 1:125,000 scale to provide sufficient detail for identifying irrigated fields and to measure the acreage within a 2 to 4% accuracy. Portions of each scene covering the Bear River Basin were quartered for enlargement to 1:125,000 scale on 40" by 40" color print stock. Eighteen such special enlargements were ordered from EROS Data Center in Sioux Falls, South Dakota.

Basin Subunit Determination

Meanwhile, the basin was divided into nine subunits along basin divides and county boundaries. The nine subunits and the counties within each subunit are listed below. Figure 2 shows a Landsat mosaic and diagram of the subunit

Basin Subunit	Counties
Idaho - 1	Oneida
Idaho - 2	Franklin and part of Caribou
Idaho - 3	Bear Lake and part of Caribou
Utah - 1	Box Elder
Utah - 2	Cache

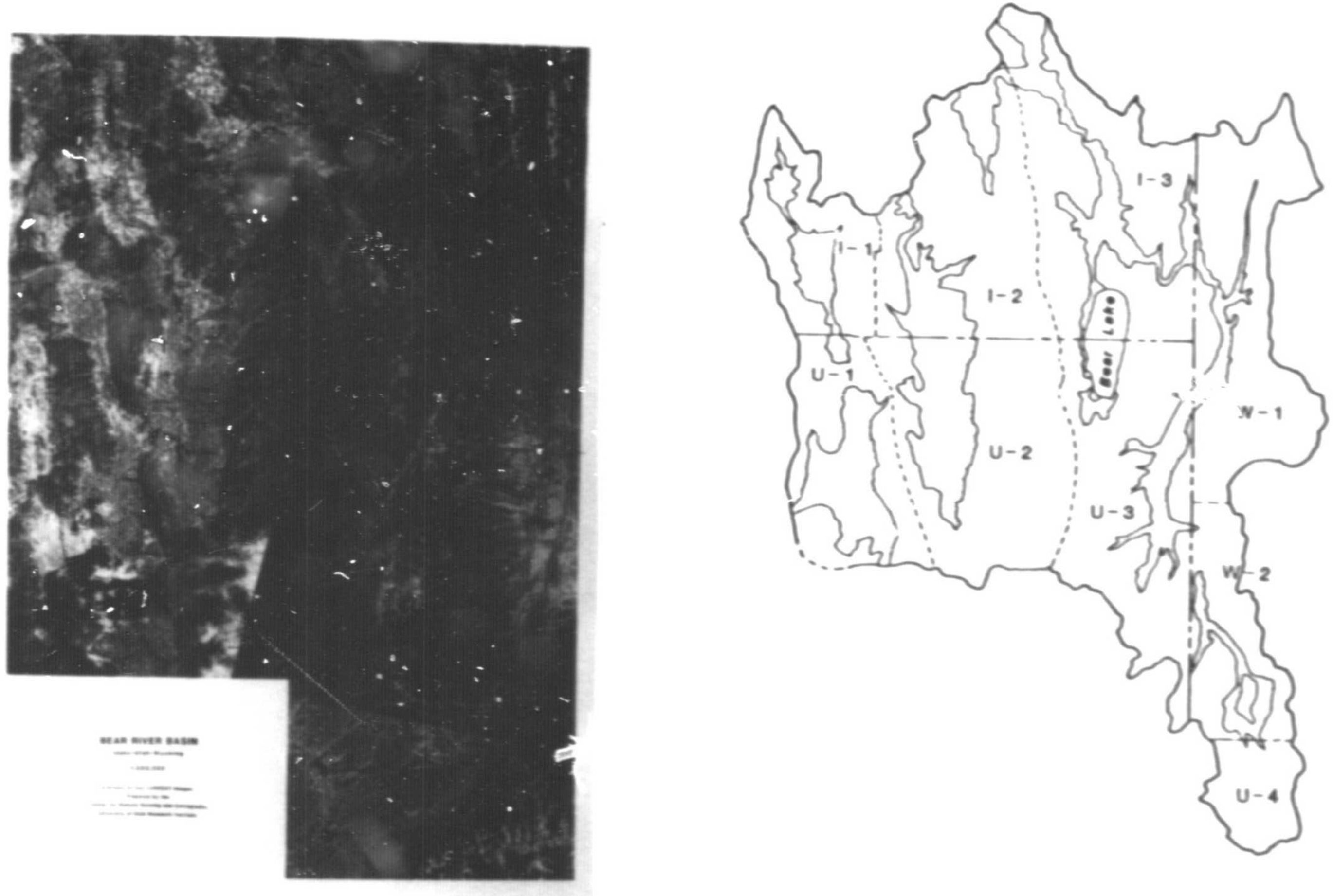

Figure 2. Photograph of the 1:250,000 scale Landsat reference mosaic of the Bear River Basin prepared for this study, and a schematic diagram showing basin inventory subunits. Irrigated cropland appears as the reddish colors in the photograph, and as the shaded portions in the diagram. Approximate scale is 1:2,000,000.

Basin Subunit	Counties
Utah - 3	Rich
Utah - 4	Summit
Wyoming - 1	Lincoln
Wyoming - 2	Uintah

Figures 3, 4, and 5 show the three-date display for units Idaho-1, Utah-1, and Wyoming-1, respectively. All nine displays are presented to the Commission to accompany this report.

Township and Section Registration

To establish the network of townships and sections for each subunit, stable control points were identified on the enlarged images that could also be identified on the 1:250,000 scale U.S.G.S. quadrangles. The township grid was then traced from the quadrangles and enlarged on the Kargl projector to 1:125,000 to fit the same control points on the Landsat images. The township boundaries were then placed on clear acetate overlays placed over the enlarged images. Clear acetate templates of sections could then be placed in each township, respectively, for specific field reference. The subunits were cut from the images and mounted on poster board with the three dates side-by-side and the township overlays in place.

Conveyance System Delineation

The next task was to delineate the extent of individual irrigation systems in the respective subunits. This was done using CIR photography of various dates and scales (1976 at 1:130,000 for Idaho, 1976 at 1:32,000 for Rich County, 1976 and 1979 at 1:30,000 and 1:130,000 for Cache and Box Elder counties) in conjunction with other documents, principally, Irrigation Conveyance Systems: Working Paper for Bear River Basin Type IV Study, Idaho-Utah-Wyoming (Soil Conservation Service, 1976). Conveyance system maps were

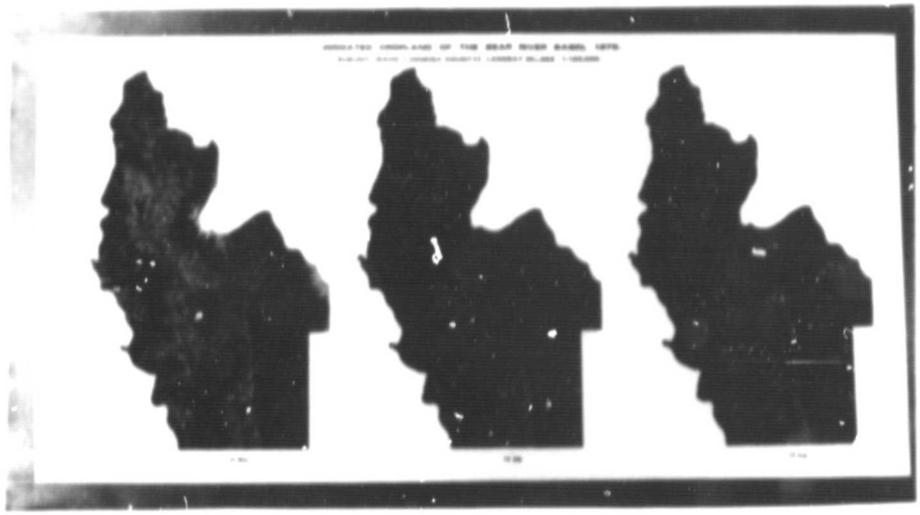

Figure 3. Photograph of the three date series of 1:125,000 Landsat images studied for the Idaho-1 (Oneida County) subunit.

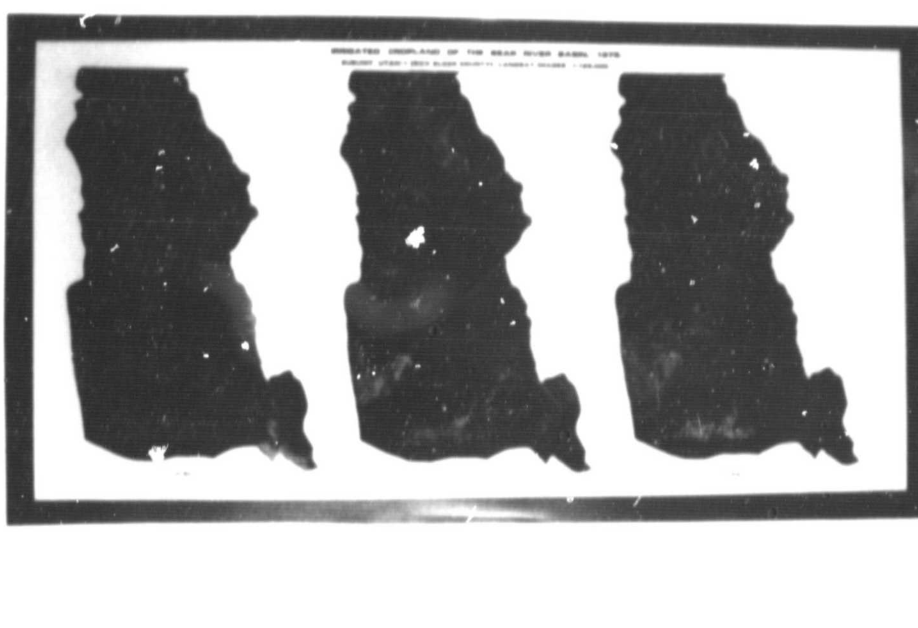

Figure 4. Photograph of the three date series of 1:125,000 Landsat images studied for the Utah-1 (Box Elder County) subunit.

Figure 5. Photograph of the three date series of 1:125,000 Landsat images studies for the Wyoming-1 (Lincoln County) subunit.

examined in the report and carefully fitted to the field patterns on the CIR photography. The boundaries so delineated were then taken to the respective Soil Conservation Service (SCS) district offices for scrutiny by the SCS staff specialists familiar with the field areas. Final adjustments were made for each conveyance system. The inventory could then proceed on the assumption that fields outside such boundaries were dryland farm areas, and were not included in the inventory. This delineation helped in both upper and lower slope areas. In upper slope areas, it helped to distinguish dry farm from irrigated fields, as shown in Figure 6. In lower areas, it helped to distinguish marsh, subirrigated pasture, riparian vegetation and bottomland from active irrigated land, as shown in Figure 7.

Data Management Format

Once the conveyance system boundaries were firmly established, they were transferred to the enlarged image scale and placed on the acetate overlay with the township boundaries. With the township grid and conveyance system perimeter placed on each of the three image dates, the analysis of irrigated land was ready to begin. The data form used is shown as Figure 8. Acreage determinations were made for each quarter section, for each date, and recorded as indicated on the form. Then, by examining all three dates, the composite maximum irrigated land acreage was recorded in the right-hand columns. The composite maximum is not just the greatest acreage of the three dates, but the total acreage that was irrigated at any time during the season.

For specific field reference, a township/section/quarter-quarter section transparent grid, shown as Figure 9, was placed on each image date for each township. With this reference system, individual fields could be identified and "monitored" across the three dates.

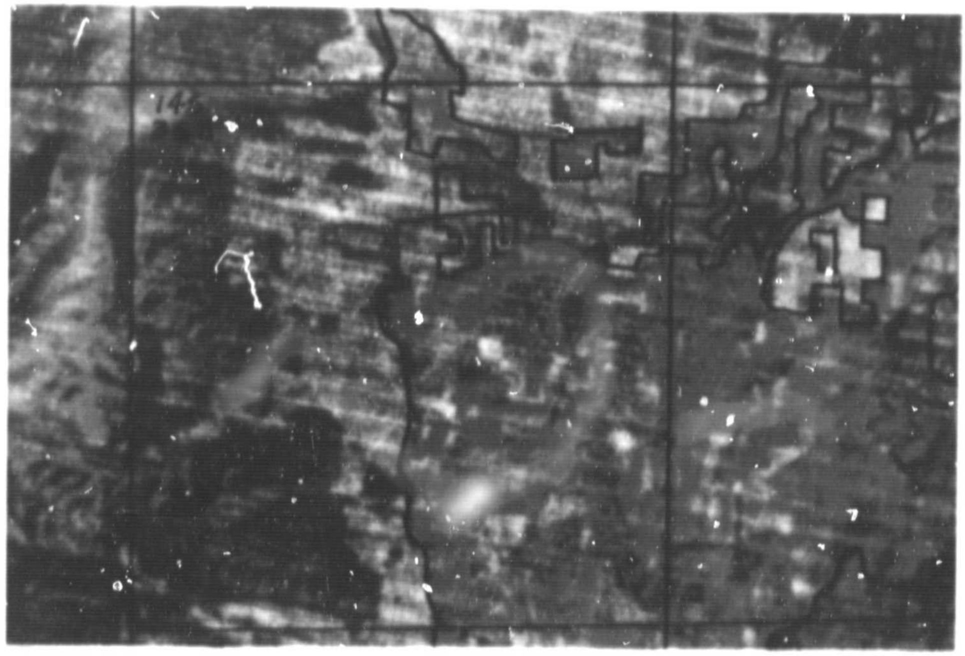

Figure 6. Close-up photograph of a portion of the Idaho-1 subunit, showing dryland farm fields (left third and top) and irrigated areas (center).

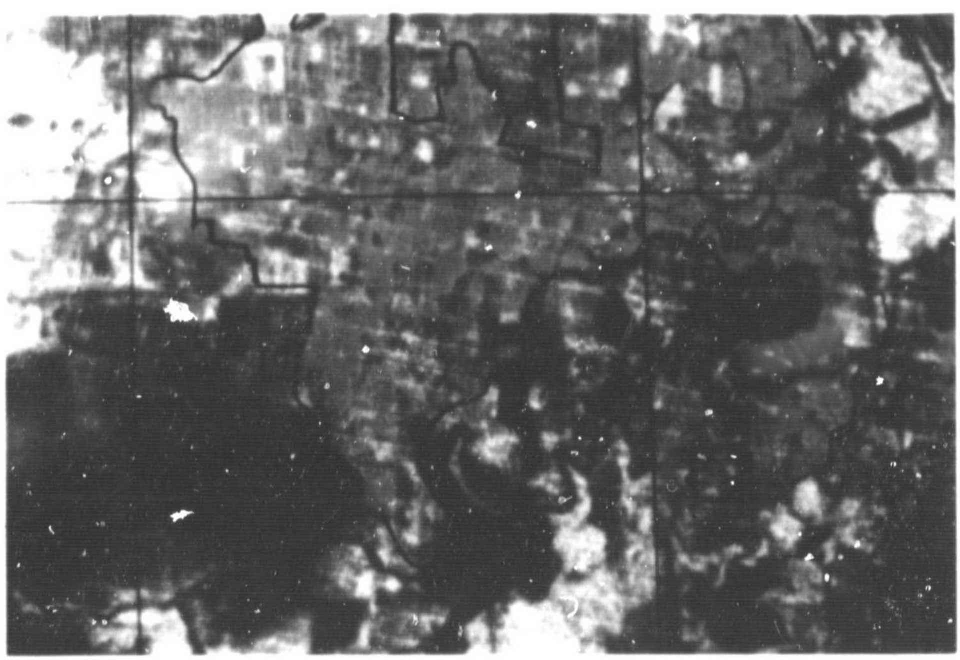

Figure 7. Close-up photograph of a portion of the Utah-1 subunit, showing wetland areas (right of center) and irrigated areas (left of center).

BEAR RIVER IRRIGATED ACREAGE, 1975

STATE ________ SUB-UNIT ________ COUNTY ______________

TOWNSHIP ______ RANGE ______ BASE & MERIDIAN __________ OBSERVER __________

SECTION EARLY: _______ MID: _______ LATE: _______ "MAXIMUM"

	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	Total
1																	
2																	
3																	
4																	
5																	
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GRAND TOTAL: ________

Figure 8. Data form used to record irrigated acreage determinations by each analyst.

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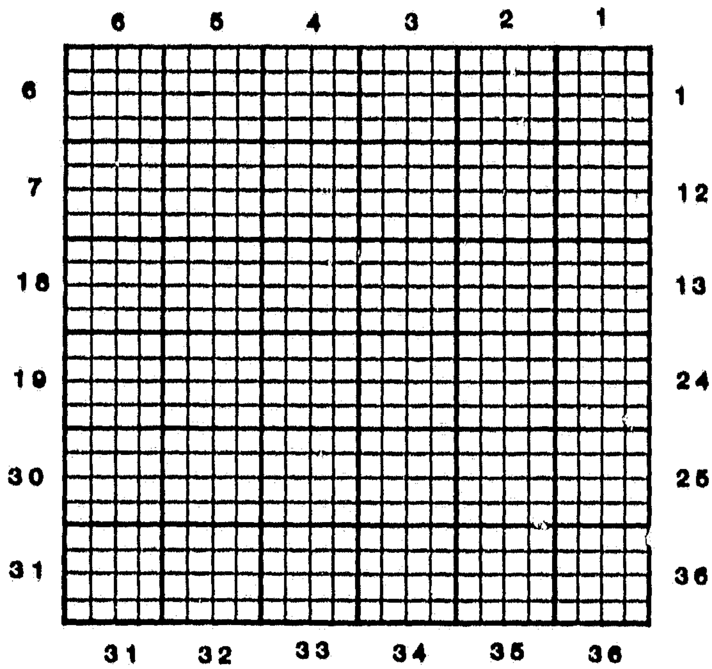

Figure 9. Clear template grid placed on each township for each date.

Irrigated Acreage Determination

Actively irrigated cropland is distinguished by its distinct red color on the image. At the enlarged scale of the imagery, there is some spatial resolution sacrificed at field boundaries that must be taken into account. By placing the township/section/quarter-quarter section template (Figure 9) in place for each township, decisions were made as to whether a given field was irrigated for each date. Acreages were generally estimated at approximately five acre increments by the analyst, based on former experience. Only the red areas within the perimeter of the conveyance system were included. Sometimes the distinction between irrigated and non-irrigated fields was difficult to detect, especially where the red tone was not very bright. The three dates generally helped to resolve the issue.

One of the major problems remaining for the analyst was to distinguish natural wetland vegetation <u>within</u> the conveyance system from the irrigated fields. This factor led to the biggest variation in interpretations. Another difficulty was the precise registration of the township grid on the image. To make sure that any misregistration does not bias final results, the user should rely primarily on the subunit totals.

The chief cause of all the above difficulties was the poor quality color imagery provided by the EROS Data Center. Heavy color saturations caused very poor field boundary distinctions. This subject is treated further in the conclusion section of the report.

For all fields throughout the basin, two analysts, working independently, recorded the irrigated acreage on the data form (Figure 8). The results of the two interpretations were compared. A third analyst independently and systematically covered all the subunits, particularly examining sections with relatively wide variation between the first two tabulations. Further spot checks were made by a fourth analyst.

RESULTS AND CONCLUSION

The results of the investigation are presented in Tables 1, 2, and 3, representing Idaho, Utah, and Wyoming, respectively. Utah Subunit 4 is included with the Wyoming data on Table 3. Again, it should be borne in mind that the township figures should not be used independently, but rather the subunit totals. As determined in the study, the total amount of irrigated land for 1975 in each of the three states is: Idaho 234,370; Utah 265,505; Wyoming 73,560; for a grand total within the basin of 573,435 acres.

As a verification procedure, a random sample of 2% of the quarter sections was selected. The quarter sections were located on U.S.G.S. 1:24,000 scale quadrangles and on the CIR photography. The quadrangles were sent to the respective District Conservationists (DC's), requesting their assistance because of their intimate knowledge of the farmlands, irrigation systems, and farm operators. The request was that the DC's, interacting with the farm operator where necessary, determine whether each parcel in the quarter section was irrigated at all during the 1975 season. Because of the impact of this request, individual farm operators were rarely contacted, but the DC and his staff made their best judgment based on their knowledge of the areas. To assist, a CRSC analyst visited each DC office, and worked with the SCS staff, referring to the ASCS photo-maps of farmlands and CIR photography where possible.

The results of this procedure are presented in Table 4. (No verification data was received from Rich County.) From this procedure, it appears that there is a basin-wide over-estimation of approximately 7.5%. It will be noted that the greatest departures between the CRSC estimates and the verification sample estimates occur where large amounts of wetland are present. This is more specifically seen at the quarter section level, where sample

Table 1. Summary of irrigated acreage in 1975 for townships in Idaho (Boise Base and Meridian).

Subunit	County	Subunit	County	Subunit	County
Idaho - 1	Oneida	Idaho - 2	Caribou & Franklin	Idaho - 3	Caribou & Bear Lake
Township & Range	Irrigated Acreage	Township & Range	Irrigated Acreage	Township & Range	Irrigated Acreage
11 S. 35 E.	60	9 S. 40 E.	1,365	8 S. 41 E.	120
12 S. 34 E.	435	9 S. 41 E.	520	8 S. 42 E.	895
12 S. 35 E.	350	10 S. 39 E.	520	9 S. 41 E.	405
13 S. 35 E.	810	10 S. 40 E.	16,240	9 S. 42 E.	1,435
13 S. 36 E.	565	10 S. 41 E.	5,280	10 S. 42 E.	2,700
14 S. 35 E.	7,195	11 S. 39 E.	130	10 S. 43 E.	2,200
14 S. 36 E.	9,350	11 S. 40 E.	10,075	11 S. 43 E.	7,035
14 S. 37 E.	140	11 S. 41 E.	6,640	11 S. 44 E.	3,565
15 S. 35 E.	3,115	12 S. 38 E.	135	12 S. 42 E.	690
15 S. 36 E.	1,720	12 S. 39 E.	940	12 S. 43 E.	3,065
16 S. 36 E.	820	12 S. 40 E.	3,275	12 S. 44 E.	6,260
		12 S. 41 E.	2,670	12 S. 46 E.	4,305
		13 S. 38 E.	3,920	13 S. 43 E.	10,680
		13 S. 39 E.	405	13 S. 44 E.	12,185
		13 S. 40 E.	335	13 S. 45 E.	170
		13 S. 41 E.	1,675	13 S. 46 E.	6,115
		14 S. 38 E.	5,805	14 S. 43 E.	7,275
		14 S. 39 E.	4,205	14 S. 44 E.	7,025
		14 S. 40 E.	3,130	14 S. 45 E.	3,760
		14 S. 41 E.	1,045	14 S. 46 E.	5,285
		15 S. 37 E.	80	15 S. 43 E.	4,400
		15 S. 38 E.	6,990	15 S. 44 E.	285
		15 S. 39 E.	13,210	15 S. 45 E.	1,650
		15 S. 40 E.	3,830	15 S. 46 E.	825
		16 S. 38 E.	5,230	16 S. 43 E.	1,570
		16 S. 39 E.	11,710		
		16 S. 40 E.	6,630		
TOTALS	24,560	Caribou:	40,770	Caribou:	2,855
		Franklin:	75,140	Bear Lake:	91,045
			115,910		93,900

Idaho Total: 234,370

Table 2. Summary of irrigated acreage in 1975 for townships in Utah (Salt Lake Base and Meridian).

Subunit	County	Subunit	County	Subunit	County
Utah - 1	Box Elder	Utah - 2	Cache	Utah - 3	Rich
Township & Range	Irrigated Acreage	Township & Range	Irrigated Acreage	Township & Range	Irrigated Acreage
15 N. 4 W.	150	15 N. 2 W.	90	15 N. 5 E.	230
15 N. 3 W.	370	15 N. 1 W.	2,115	15 N. 6 E.	105
14 N. 4 W.	30	15 N. 1 E.	2,965	14 N. 5 E.	1,300
14 N. 3 W.	1,775	15 N. 2 E.	585	14 N. 6 E.	230
13 N. 3 W.	2,005	14 N. 2 W.	2,370	14 N. 8 E.	60
13 N. 2 W.	1,615	14 N. 1 W.	9,435	13 N. 5 E.	5,175
12 N. 4 W.	1,520	14 N. 1 E.	17,920	13 N. 6 E.	1,130
12 N. 3 W.	7,465	14 N. 2 E.	900	13 N. 7 E.	300
12 N. 2 W.	2,770	13 N. 2 W.	900	13 N. 8 E.	1,940
11 N. 4 W.	5,420	13 N. 1 W.	10,640	12 N. 5 E.	1,890
11 N. 3 W.	15,415	13 N. 1 E.	13,695	12 N. 6 E.	40
11 N. 2 W.	6,450	13 N. 2 E.	180	12 N. 7 E.	4,660
10 N. 4 W.	245	12 N. 1 W.	7,000	12 N. 8 E.	3,250
10 N. 3 W.	9,485	12 N. 1 E.	14,860	11 N. 6 E.	1,915
10 N. 2 W.	8,745	11 N. 1 W.	12,145	11 N. 7 E.	13,820
9 N. 3 W.	5,140	11 N. 1 E.	14,955	11 N. 8 E.	830
9 N. 2 W.	7,180	10 N. 1 W.	3,330	10 N. 6 E.	720
9 N. 1 W.	1,310	10 N. 1 E.	8,420	10 N. 7 E.	4,350
8 N. 2 W.	935	9 N. 1 E.	2,275	9 N. 6 E.	1,375
		9 N. 2 E.	140	9 N. 7 E.	9,605
				9 N. 8 E.	930
				8 N. 6 E.	235
				8 N. 7 E.	6,635
				8 N. 8 E.	100
				7 N. 7 E.	240
TOTALS	78,025		124,740		61,065
Utah Total:	265,505				

Table 3. Summary of irrigated acreage in 1975 for townships in Utah (Salt Lake Base and Meridian) and Wyoming (6th Principal Base and Meridian).

Subunit	County	Subunit	County	Subunit	County
Utah-4	Summit	Wyoming-1	Lincoln	Wyoming-2	Uinta
Township & Range	Irrigated Acreage	Township & Range	Irrigated Acreage	Township & Range	Irrigated Acreage
3 N. 10 E.	1,675	27 N. 120 W.	130	18 N. 121 W.	275
		26 N. 120 W.	850	18 N. 120 W.	140
		26 N. 119 W.	230	17 N. 121 W.	5
		26 N. 118 W.	920	17 N. 120 W.	1,830
		25 N. 120 W.	280	16 N. 121 W.	2,340
		25 N. 119 W.	5,665	16 N. 120 W.	420
		25 N. 118 W.	3,140	15 N. 121 W.	600
		24 N. 120 W.	60	15 N. 120 W.	4,870
		24 N. 119 W.	7,240	14 N. 121 W.	890
		24 N. 118 W.	270	14 N. 120 W.	1,370
		23 N. 120 W.	700	14 N. 119 W.	3,635
		23 N. 119 W.	6,465	13 N. 120 W.	4,270
		22 N. 120 W.	6,370	13 N. 119 W.	10,150
		22 N. 119 W.	1,650	13 N. 118 W.	125
		21 N. 120 W.	240	12 N. 120 W.	3,220
				12 N. 119 W.	5,210
TOTALS	1,675		34,210		39,350

Wyoming Total: 73,560

Table 4. Summary of comparisons of the amount of irrigated acreage in selected test sites (160-acre quarter sections) as determined from Landsat images and from S.C.S. personnel.

State	County	#Test Sites	Landsat Total (ac.)	S.C.S. Total (ac.)	% Difference
Idaho	Oneida	7	680	677	0.4
	Caribou	11	1,030	904	13.9 *
	Franklin	14	1,405	1,234	13.9 *
	Bear Lake	17	1,800	1,511	19.1 *
Utah	Box Elder	12	1,650	1,618	2.0
	Cache	26	3,075	3,057	0.6
Wyoming	Uinta	4	330	242	36.4 *
	Lincoln	4	520	514	1.2
		95	10,490	9,757	7.5

* Close examination of the study sites for which large differences were found generally revealed wetland areas adjacent to fields.

tracts that fell largely in wetlands resulted in widely varied estimates. Specifically, the Landsat interpretations often identified such wetlands as irrigated. Thus, there is a general overstatement of irrigated land in such areas. At the onset of the study, as indicated in the proposal, this was a major concern. Again, a major contributor to this difficulty was the relatively poor quality (i.e., as compared to imagery received previously for more recent data) imagery supplied by EROS Data Center.

As a final note, we must make additional comment on the quality of the Landsat imagery. Upon first receipt of the products, we were very disturbed. Calling EROS with our concern resulted in a suggestion that we "try it", that with such enlargements we should not expect better resolution. After considerable effort to use the material, realizing that no other agency can officially provide such photographic products, we only became increasingly disappointed.

Finally, another appeal was made to EROS to evaluate and improve, if possible, the quality of the products (Appendix A). The result was negative (Appendix B). EROS would claim no responsibility, and responded that these products were as good as could be made.

Unwilling to accept such a conclusion, and based on our former experience with these very same problems on another study, which produced highly accurate results, we approached another agency. This agency, located in Salt Lake City, has been stripped of authority to do such work by the Department of Interior (EROS). The agency spent two days and turned out a product very much improved over the EROS product. Several samples were prepared. The colors were less saturated and field distinctions much sharper. Some sample sites were checked with the templates. Fortunately, results were very close to the CRSC estimates using EROS images, within 5% or so, overall. However, wetlands are more distinguishable on the locally-processed imagery.

Had this difficulty been anticipated, CRSC would have recommended a computer contrast enhancement technique to improve the quality by taking digital data directly from NASA and creating significantly improved visual products, as we have created on other projects where special resolution is critical.

In the final analysis, our conclusion is that this would be the best way to verify or improve the findings. Further investigation is needed to distinguish wetland, and to deduct the acreage from the amounts estimated herein.

REFERENCES CITED

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Soil Conservation Service. 1976. Irrigation Conveyance System Inventory Summary, Bear River Basin, Idaho-Utah-Wyoming. U.S.D.A. Working Paper for Bear River Basin Type IV Study.

Appendix A

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

CENTER FOR REMOTE SENSING AND CARTOGRAPHY
420 CHIPETA WAY, SUITE 190
SALT LAKE CITY, UTAH 84108
TELEPHONE 801-581-8016

March 5, 1982

U.S. Geological Survey
EROS Data Center
User Services
Sioux Falls, South Dakota 57198

Attention: Judy Collins/Kent Hegge

Dear Judy and Kent:

In two separate packages (a tube and a flat package) we are sending you a representative sample of the 18 sub-scene double enlargements I described on the telephone. The scene ID's and dates are given on each parcel. You will see there is a range in quality, but in general, they are far worse than <u>any</u> other double enlargements we've ever had.

I am extremely concerned about (a) the accuracy of our work, and (b) the negative impact it will have on our credibility (and Landsat's credibility) in three states. As you know, in many quarters Landsat is still in the early stages of acceptance, overcoming the oversell of the early years. Many resource people looking at these products are likely to conclude that, if this is the best Landsat can do, forget it. I am sure it is not the best Landsat can do, based on our earlier experience, and products, which helped us to win this contract. Unfortunately, this package is going to three states, all with a vested interest in this study, because the Bear River's waters are being re-adjudicated on the basis of 1975 irrigation acreages we provide. We really have a challenge on our hands!

We recognize the quality of raw data varies, and so we have really tried to do our best with the product. Something inside won't die. There is just too much at stake.

At any rate, we deeply appreciate your most gallant effort to help us and these states. Of most critical concern are scene ID's 82173-173025

(41-31 14 July 1975) and 85113-171645 (41-31 10 August 1975). If you can kick up the quality (reduce the bleeding, reduce the heavy dosages of blue and/or red), anything to make the irrigated field patterns more discrete, we'd love you forever, and try very hard to think of something nice to do for you.

Attached is a copy of the original order. Thank you very much for whatever you can do to restore us to good health.

Sincerely,

Merrill K. Ridd
slb

Merrill K. Ridd
Director

MKR:slb

Enclosure

United States Department of the Interior

GEOLOGICAL SURVEY
EROS Data Center
Sioux Falls, South Dakota 57198

IN REPLY REFER TO

March 16, 1982

Mr. Merrill K. Ridd
Director
University of Utah Research Institute
Center for Remote Sensing and Cartography
420 Chipeta Way, Suite 190
Salt Lake City, Utah 84108

Dear Mr. Ridd:

After discussing your concerns with Ms. Judy Collins and Mr. Kent Hegge of this department, I reviewed the history of the order (July 1981) and the goals that you were attempting to achieve.

We have long had a point of discussion concerning "How much can you enlarge a Landsat scene before it starts falling apart." Our policy has been that anything of a larger scale than 1:250000 cannot be guaranteed and is strictly up to the user. This especially applies to older Landsat data that was of less than good quality and provided to us by NASA on 70mm negatives at a scale of 1:3369000. We're looking at somewhere around a 27X enlargement and a 5th generation product. Needless to say, that exceeds the realistic limits of the system.

Had the scenes been acquired subsequent to February, 1979, you would have realized an acceptable product due to the electronic transmission of the data to us and the reduction in generation.

I would strongly recommend that you consider a digital to photo avenue in meeting your needs with the older data. By acquiring Computer Compatible Tapes (CCT's), you would have several options in processing the data and undoubtedly retain or enhance your organization's credibility.

May I suggest that you contact Dr. Frederick Waltz of our Applications Branch staff who can discuss the subject with you and provide some idea on how much benefit could be realized. His telephone number is (605) 594-6114.

We have checked our data base and six of the eight scenes involved have CCT's residing at EDC.

Your products have been returned to you and if we can be of any further assistance in resolving your situation please contact us.

Sincerely,

Leo A. Braconnier
User Services Officer

Enclosure - 1 CPL