Senior Thesis

FOR 497

A GIS Analysis of White-Tailed Deer Winter Range in the East Hatter Creek Watershed, Idaho

Jake Powell

December 1999

Thesis Advisors:

Harold Osborne

Molly Stock

Table of Contents

Abstract

The availability of suitable winter range is critical for the survival of white-tailed deer (*Odocoileus virginianus*). White-tailed deer need old-growth or mature second-growth closed-canopy forests to provide sufficient thermal cover to withstand the cold north Idaho winters. Timber harvest can diminish the quality of white-tailed deer winter range by removing needed thermal cover. The goal of this research was to determine the location of suitable white-tailed deer winter range, according to land ownership, in the East Hatter Creek Watershed (EHCW). Digital orthophoto quadrangles (DOQ) and hyperspectral images were analyzed using the GIS (geographic information system) program ARCVIEW. Currently there are 206 acres of suitable white-tailed deer winter range in the EHCW. The University of Idaho owns 101 acres (46%) and Bennett Lumber owns 117.5 acres (54%) of this acreage. Approximately 619 more acres will be available as winter range habitat in the EHCW as the forest matures and the canopy closes. The University of Idaho and Bennett Lumber each own 298 acres (48% apiece) of this potential winter range habitat in the EHCW; two private landowners own the remaining 24 acres (4%). In the EHCW, roughly 315 acres are considered marginal habitat.

Introduction

Background

Throughout the summer and fall, white-tailed deer thrive in the forested habitats on the Palouse Range of northern Idaho. The deer are able to forage on an abundance of grasses, forbs, and browse in a variety of habitats. Portions of these habitats have been logged, creating openings in the canopy that stimulate the growth and production of white-tailed deer forage and browse (Peek 1992). The white-tailed deer benefit from the interspersion of forage and cover in these harvested areas (Pauley et al. 1993).

However, when the leaves start turning gold and fall gives way to winter, a change occurs on the landscape and in deer behavior. The once-abundant forage dwindles and the deer must work harder to find an available food source. Colder temperatures and the presence of deep snow finally drive the deer down from higher elevations onto their low-lying winter range habitats.

The use of winter range habitats by white-tailed deer varies with time of year, snow accumulation, and severity of winter. White-tailed deer will select lodgepole pine (*Pinus contorta*) and Douglas-fir (*Pseudotsuga menziesii*) pole timber stands during early (November - January) and late (March - April) winter when snow depth usually does not exceed 30 cm. These conifer stands provide the greatest abundance of preferred forage species. During mid-winter (January - February) and over severe winters when snow accumulation is greater than 40 cm, white-tailed deer select western red cedar (*Thuja plicata*) and western hemlock (*Tsuga heterophylla*) old-growth timber stands. These stands are usually characterized by depauperate understories, dense canopy cover, and low snow accumulation (Peek 1992, Pauley et al. 1993).

As the severity of winter increases, finding areas that provide snow interception and thermal cover is critical for the survival of white-tailed deer (Fields 1998). Thermal cover is more important than the quantity and quality of forage to white-tailed deer on their winter range. Thermal cover provides a stable environment in which deer can conserve the greatest amount of energy (Pauley et al. 1993, Reese 1999). Because conifer stands must have a canopy closure of at least 70% (80% is preferred) to be effective as thermal cover, old-growth and mature second-growth conifer stands are selected by white-tailed deer on the winter range (Jageman 1984, Peek 1992, Pauley et al. 1993). To be effective as thermal cover, a minimum stand size of 2 to 5 acres and a minimum width of 300 feet are needed (Jageman 1984).

On the Palouse Range, lower south and southwest-facing slopes are favored by wintering white-tailed deer (Pauley et al. 1993). Suitable winter range is generally located below 3200 feet elevation, depending on the severity of the winter (Fields 1998). Conifer stands 30 to 50 years old with an average height of 33 feet provide adequate shelter for white-tailed deer wintering on the Palouse Range (Owens 1981). A cover-to-opening ratio of 4:1 or 5:1 on drier habitat types is also desirable (Fields 1998). The minimum size of canopy openings (clearcuts) varies slightly, but, in general, canopy openings should be 10 to 20 acres or less, and it is important that timber harvest not fragment the area so much as to destroy thermal and hiding cover (Jageman 1984, Peek 1992, Fields 1998).

The East Hatter Creek watershed is located south of Potlatch, Idaho, on the north side of the Palouse Range (Figure 1). Many of the critical winter range habitat requirements described above are qualities of the EHCW. For example, the watershed covers approximately 3350 acres, with about 2500 acres below 3200 feet elevation, and, therefore, is considered prime winter range. This watershed provides critical winter range habitat for a sizable herd of white-tailed deer that summer on the Palouse Range.

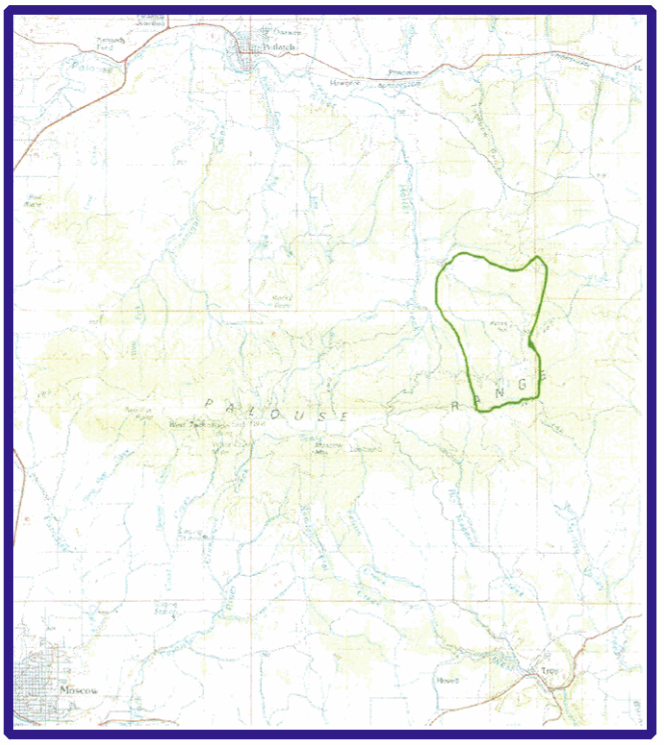


Figure 1. The East Hatter Creek Watershed.

White-tailed deer are important members of the biotic community in the EHCW. White-tailed deer provide non-consumptive users of wildlife resources, e.g., hikers, bikers, and photographers, many viewing opportunities that greatly enhance their recreational enjoyment. White-tailed deer are also very important to hunters. In Game Management Unit 8 (the unit in which the EHCW resides), 1,788 hunters spent 12,359 days and harvested 673 deer in 1997. In 1998, 770 deer were harvested by deer hunters in the same unit (IDFG 1999). The money generated from the sale of hunting licenses, tags, sporting equipment, fuel, food, and lodging spent while hunting white-tailed deer greatly benefit local businesses and communities. White-tailed deer are also an important prey species for many predators.

Problem

Land ownership in the East Hatter Creek watershed is divided among the University of Idaho, Bennett Lumber Products, and other private owners (Figure 2). Timber harvest and production is one of the primary uses of the land in East Hatter Creek. The harvest of timber in certain locations in the watershed has the potential to diminish the quality of white-tailed deer winter range by removing excessive amounts of thermal cover. We do not know which landowners in the watershed own the sites that have the most potential to be suitable as white-tailed deer winter range habitat, and which, therefore, are at greatest risk from timber harvest operations.

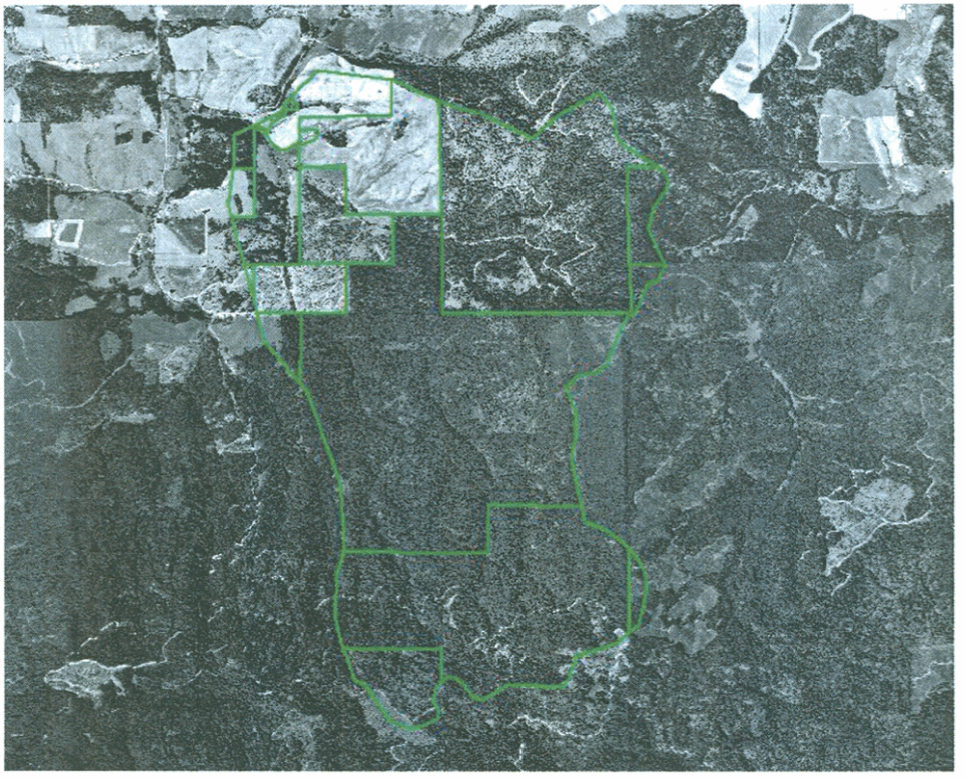


Figure 2. Land ownership in the EHCW is divided among sixteen different owners.

Objectives

The purpose of this research project was to determine the location of the prime white-tailed deer winter range in the EHCW. The specific objective was to identify the proportion of habitat, according to land ownership, that is the most suitable as white-tailed deer winter range in the EHCW.

Methods

1998 DOQ photographs of the EHCW, obtained from Potlatch Timber Corporation, were analyzed with the aid of a stereoscope, and stand densities, (i.e., percent canopy closure), were determined. The stands were classified as having greater than 70 percent canopy closure, 30 to 70 percent, or less than 30 percent canopy closure. Hyperspectral images of the watershed helped to determine the species composition of the timber.

Within the watershed boundary, critical stand characteristics (i.e., species composition and canopy closure) were determined and polygons were delineated with the digitizing function in Arcview (Figure 3). Numeric values were assigned to the newly digitized polygons to describe the stand characteristics.

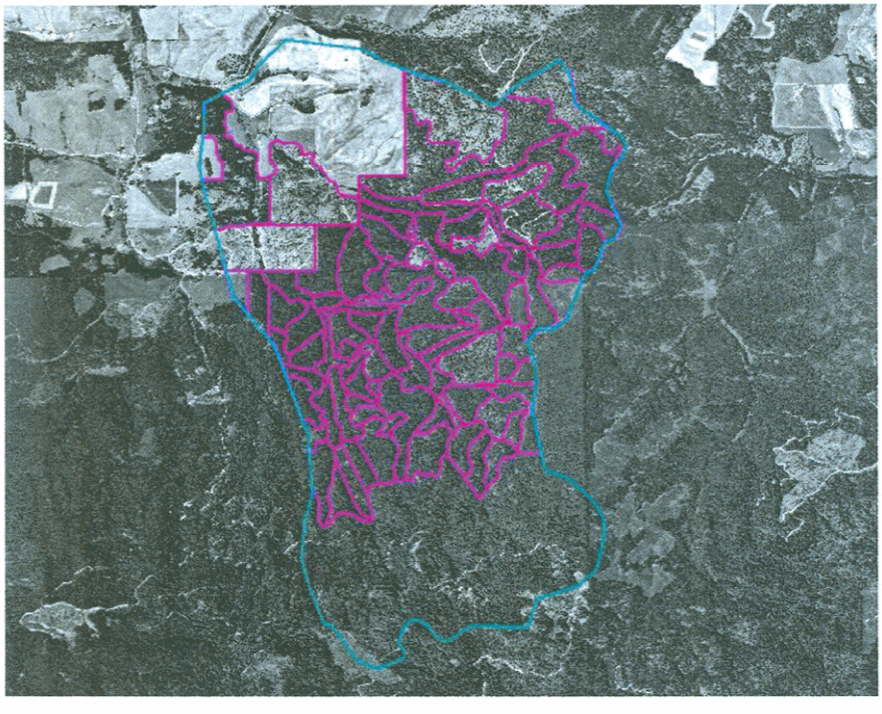


Figure 3. Digitized polygons in the EHCW.

Ground-truthing of the digitized polygons was necessary to refine the attributes assigned to a particular stand. Ground-truthing was accomplished by selecting a few random stands and then locating them on the ground to compare the habitat on the ground to what was identified in the DOQ's or hyperspectral images.

A digital elevation model (DEM) of Moscow Mountain (the EHCW is located on Moscow Mountain) was used to derive the slope and aspect of topography within the EHCW using Arcview. The newly digitized polygons within the EHCW were converted from vector data to a grid so that they could be combined with the newly derived slope and aspect (which is in a grid format). Using the Map Query feature in Arcview, the areas that had >70 percent canopy closure, below 3200 feet elevation, and a south or southwest aspect were located. These areas are high quality winter range. Potential winter range was determined by using the Map Query to find the areas that were south or southwest aspect and <70 percent canopy closure. Marginal winter range habitats were defined as being north, northeast, or west aspects with <10 percent slopes.

Results

Roughly 218 acres of high quality winter range are located in the EHCW (Figure 4). The University of Idaho owns 101 acres (46%), and Bennett Lumber owns 117 acres (54%) of the current white-tailed deer winter range habitat. Approximately 619 acres will be available in the future as winter range habitat in the EHCW as the forest matures and the canopy closes (Figure 5). The University of Idaho and Bennett Lumber each own 298 acres (48% apiece) of the potential winter range habitat in the EHCW. Two private landowners own the remaining 24 acres (4%) of the potential white-tailed deer winter range in the EHCW. Currently, there are 315 acres of marginal winter range habitat in the EHCW (Figure 6).

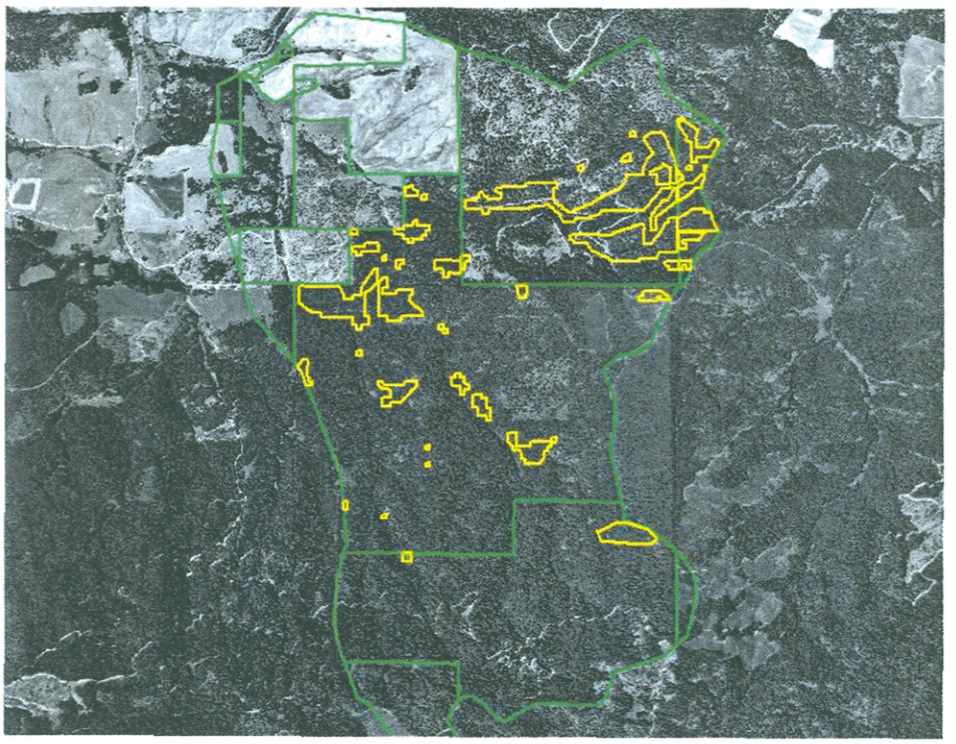


Figure 4. The location of high quality winter range in the EHCW.

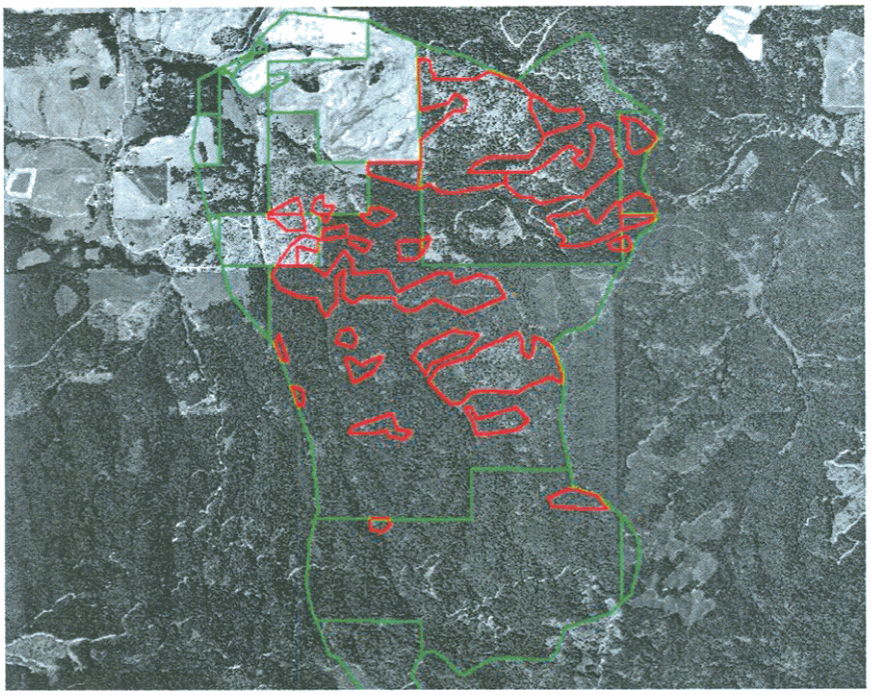


Figure 5. The location of habitat that will be available in the future as winter range in the EHCW.

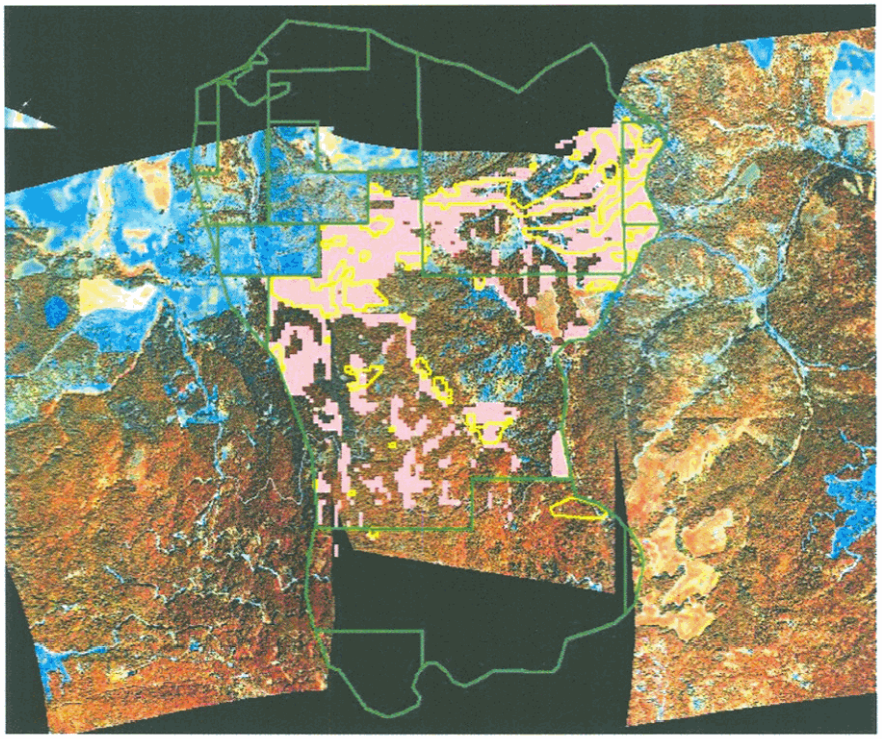


Figure 6. The location of marginal winter range habitat in the EHCW (outside of the high quality habitats).

Discussion

The enhancement or at least the retention of critical white-tailed deer winter range habitat in the EHCW is vital to ensure a healthy white-tailed deer herd on the Palouse Range for both consumptive and non-consumptive users of our wildlife resources to enjoy. The 218 acres of current high quality winter range accounts for only 8% of the land area below 3200 feet elevation in the EHCW. This 218 acres of high quality habitat is not enough to suit the needs of the deer in East Hatter Creek. The white-tailed deer are selecting marginal winter range habitats because of a lack of high quality sites. If north Idaho receives another harsh winter (e.g., 1996-97) the white-tailed deer will face extreme die-offs and winter kill.

Forest landowners also need to try to move some of the 619 acres of potential habitat into high quality habitat. This will be accomplished by site-specific management activities. Timber thinnings, cleanings, and improvement cuts may be necessary to expedite succession in these stands. The best management activity on some of these sites may also be no management. A little time may be all that some stands need to grow and mature into suitable white-tailed deer winter range habitat.

Retention and the enhancement of these habitats will require a coordinated effort between the University of Idaho and Bennet Lumber. It is imperative to coordinate management activities in the EHCW to ensure that white-tailed deer have suitable winter range, and fortunately timber managers are generally very willing to protect critical habitats for wildlife.

White-tailed deer can benefit from sound silvicultural practices that will enhance white-tailed deer winter range. By determining the location of prime white-tailed deer winter range in the East Hatter Creek watershed, management activities (primarily timber harvest) can be accomplished in a manner that will not be detrimental to the white-tailed deer or to their limited

winter range habitat. Timber harvest can still occur on white-tailed deer winter range if it is done with the habitat needs of deer in mind and sufficient amounts of critical thermal cover are retained. As young timber stands go through the different stages of succession and develop canopy closures that qualify for white-tailed deer thermal cover, it may be feasible to harvest mature timber on decadent stands that had been previously used as winter range habitat. As newly harvested stands regenerate, they will provide important forage and browse that will be used heavily by white-tailed deer if suitable cover is nearby. Thinnings will also be necessary to reduce density dependant mortality of trees and to provide growing space and nutrients for remaining trees. Healthy trees have full crowns and will provide maximum snow interception and thermal cover for white-tailed deer.

Timber harvest on high quality sites in the EHCW should be limited to small clearcuts, group selection cuts, and thinnings. A hot broadcast burn in harvested areas will also promote the regeneration of important browse species that will benefit white-tailed deer. On the drier sites, planting Douglas-fir instead of pines will enhance the amount of snow interception and thermal cover available to deer. The retention of western redcedar and possibly spruce is important because these species provide excellent thermal cover for deer. It is important to maintain riparian buffer strips as these areas are important winter habitat and are used as critical travel corridors for deer. Access restrictions in the winter will benefit deer by reducing stress and minimizing harassment to them during the most critical period of the year.

The management activities in the EHCW can also be used as a valuable teaching tool for students, the general public, private timber owners, and the logging industry. Many landowners want to obtain some income from their timber parcels while enhancing wildlife habitat.

The management activities in the EHCW can be a good example of how the habitat needs of white-tailed deer and a suitable supply of merchantable timber can both be met if some consideration is given in the planning of timber harvest.

Literature Cited

Fields, J. 1998. Basic White-tailed Deer Winter Range Requirements. Unpublished manuscript. University of Idaho.

Jageman, H. 1984. White-tailed Deer Habitat Management Guidelines. Forest, Wildlife, and Range Experiment Station Bulletin #37. University of Idaho. Moscow, ID. pp. 9-11.

Owens, T. E. 1981. Movement patterns and determinants of habitat use of white-tailed deer in northern Idaho. M. S. Thesis, Univ. of Idaho, Moscow.

Pauley, G. R., J. M. Peek, and P. Zager. 1993. Predicting white-tailed deer habitat use in northern Idaho. Journal of Wildlife Management 57(4):904-913.

Peek, J. M. 1992. White-tailed deer: Northern Rocky Mountains. Alces 1: 497-504.

Peek, J. M. 1999. Personal communication.

Reese, K. P. 1999. Wildlife 316 class. Department of Wildlife Resources, University of Idaho.

Ownership of the East Hatter Creek Watershed

Shape	Area	Perimeter	Owner#	Owner-id	Parcelno	Acreage	Owner1	Owner2	Owner3
Polygon	346844.772	3298.872	0	0	414252475	85.71	Smick, Harold (UND 1/2 INT)	Zorb, Inc (UND 1/2 INT)	
Polygon	65628.516	1447.346	0	0	413285558	16.22	University of Idaho		
Polygon	205692.307	2296.872	0	0	413285558	50.83	University of Idaho		
Polygon	2610622.760	7202.343	0	0	414362506	645.08	Bennett Tree Farms, Inc		
Polygon	875654.474	4723.064	0	0	414350055	216.37	La Rue, Margaret Elaine		
Polygon	8240.290	571.312	0	0	414266336	2.04	Moore, Milton L & Beverly A		
Polygon	2237.315	290.253	0	0	414266336	0.55	Moore, Milton L & Beverly A		
Polygon	12327.966	658.088	0	0	414266346	3.05	Federal Land Bank	Nagle, Patrick & Valarie	
Polygon	54278.492	993.605	0	0	414340044	13.41	Gage, Duane F		
Polygon	460424.508	3338.994	0	0	414347274	113.77	Williams, Thom & Joanna		
Polygon	13709.156	497.831	0	0	414352405	3.39	Cochrane, Delbert M		
Polygon	480030.609	3198.837	0	0	414357825	118.62	Hemmelman, Wayne		
Polygon	80868.581	1191.489	0	0	414341204	19.98	Carpenter, Robert I		
Polygon	4705781.399	10837.098	0	0	414357225	1162.80	University of Idaho		
Polygon	318688.177	2371.073	0	0	414356455	78.75	Roberts, Bruce M & Patricia A		
Polygon	12038.885	526.774	0	0	414349004	2.97	Roberts, Bruce M	Roberts, Patricia A	
Polygon	60004.586	1270.307	0	0	403060005	14.83	USDA Forest Service		
Polygon	2013.573	280.445	0	0	414349804	0.50	Snider, Doralee		
Polygon	132316.459	1660.632	0	0	404023901	32.70	Rogers, Larry A & Debbie A		
Polygon	2718775.890	7581.097	0	0	404094849	671.81	Bennett Tree Farms, Inc		
Polygon	394955.669	2640.435	0	0	404108440	97.59	City of Troy		

Current Winter Range 1999

Approximately 218 Acres

Shape	ID	Area	Perimeter	Hectares	Acres	Owner
Polygon	0	254533.903	5136.799	25.453	62.894	Bennett
Polygon	0	134085.321	2247.466	13.409	33.134	Bennett
Polygon	0	107046.933	2098.128	10.705	26.452	Idaho
Polygon	0	57258.537	1356.524	5.726	14.149	Idaho
Polygon	0	38611.866	823.125	3.861	9.541	Idaho
Polygon	0	34299.756	1172.477	3.430	8.476	Idaho
Polygon	0	29069.434	1108.026	2.907	7.183	Idaho
Polygon	0	26224.842	1024.296	2.622	6.479	Idaho
Polygon	0	20434.994	797.257	2.043	5.048	Idaho
Polygon	0	18028.224	627.666	1.803	4.455	Idaho
Polygon	0	16741.109	834.026	1.674	4.136	Bennett
Polygon	0	15968.443	630.920	1.597	3.946	Idaho
Polygon	0	15124.635	627.318	1.512	3.736	Idaho
Polygon	0	12776.594	653.094	1.278	3.158	Idaho
Polygon	0	11696.248	587.928	1.170	2.891	Idaho
Polygon	0	10413.570	549.480	1.041	2.572	Idaho
Polygon	0	10118.645	554.968	1.012	2.501	Idaho
Polygon	0	8672.154	493.334	0.867	2.142	Idaho
Polygon	0	5546.649	306.348	0.555	1.371	Idaho
Polygon	0	5484.002	320.774	0.548	1.354	Bennett
Polygon	0	4833.710	359.858	0.483	1.193	Idaho
Polygon	0	3894.328	249.708	0.389	0.961	Bennett
Polygon	0	3720.095	308.297	0.372	0.919	Bennett
Polygon	0	3494.824	234.904	0.349	0.862	Bennett
Polygon	0	3126.630	247.160	0.313	0.773	Idaho
Polygon	0	2407.773	232.080	0.241	0.596	Idaho
Polygon	0	2225.856	248.948	0.223	0.551	Idaho
Polygon	0	2154.960	196.726	0.215	0.531	Idaho
Polygon	0	1947.964	188.801	0.195	0.482	Idaho
Polygon	0	1417.402	151.161	0.142	0.351	Idaho
Polygon	0	1233.167	140.686	0.123	0.304	Bennett
Polygon	0	1187.152	138.062	0.119	0.294	Idaho
Polygon	0	1174.174	137.185	0.117	0.289	Bennett
Polygon	0	1064.311	130.725	0.106	0.262	Idaho
Polygon	0	1061.088	130.317	0.106	0.262	Idaho
Polygon	0	1046.166	126.668	0.105	0.259	Bennett
Polygon	0	1045.026	129.393	0.105	0.259	Idaho
Polygon	0	1006.919	127.684	0.101	0.250	Idaho
Polygon	0	999.829	126.483	0.100	0.247	Idaho
Polygon	0	880.999	117.202	0.088	0.217	Idaho
Polygon	0	562.943	113.357	0.056	0.138	Idaho
Polygon	0	199.396	133.854	0.020	0.049	Idaho

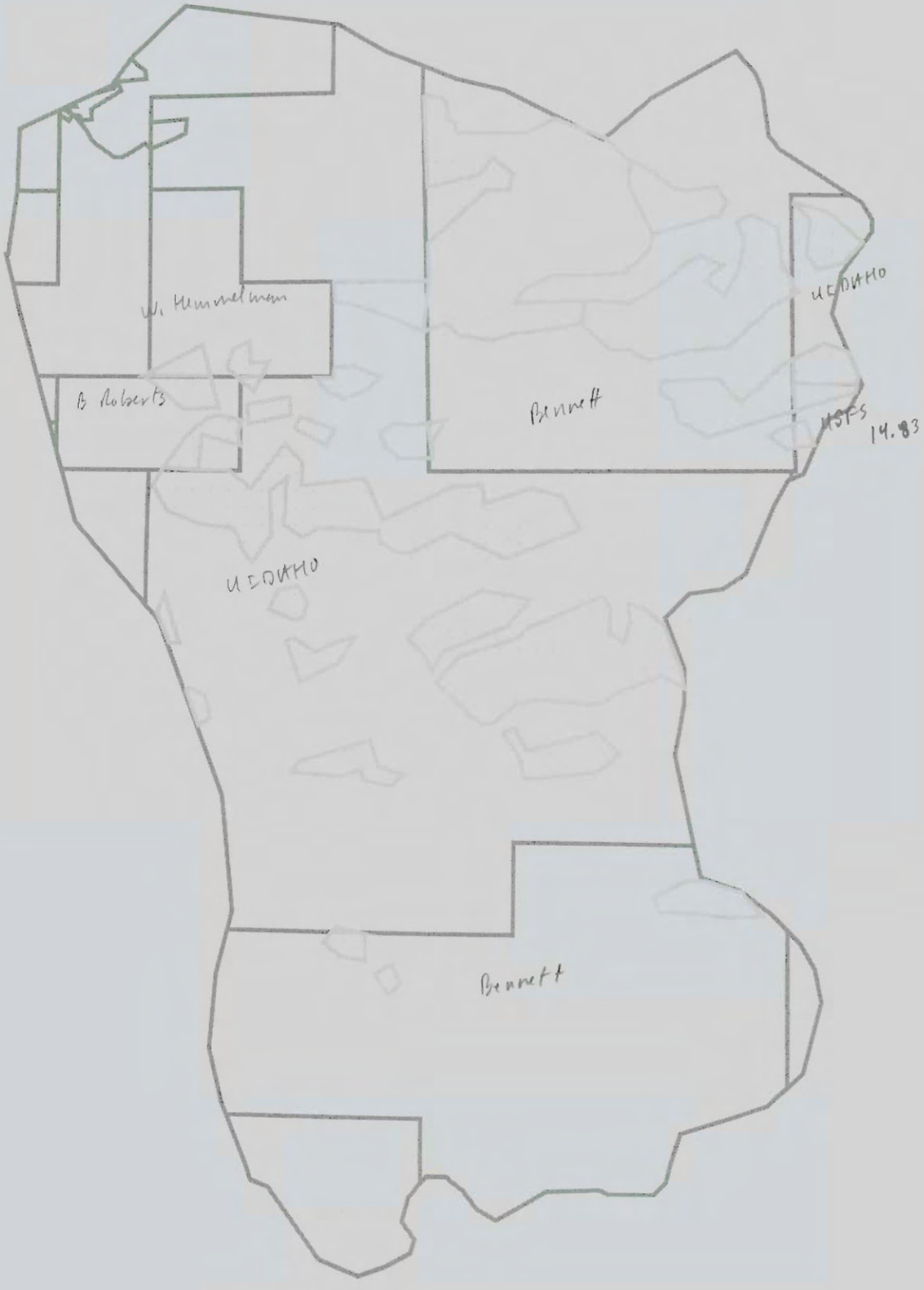
Potential Winter Range
Approximately 619.3 Acres

Shape	ID	Area	Perimeter	Hectares	Acres	Owner
Polygon	0	23250.953	684.007	2.325	5.745	Uldaho
Polygon	0	15019.127	536.876	1.502	3.711	Uldaho
Polygon	0	265179.598	2917.536	26.518	65.526	Bennett
Polygon	0	70831.309	1210.234	7.083	17.502	Bennett
Polygon	0	10438.194	449.125	1.044	2.580	Uldaho
Polygon	0	33243.916	1026.571	3.324	8.214	Roberts, B.
Polygon	0	397878.231	5173.446	39.788	98.316	Uldaho
Polygon	0	27812.098	849.379	2.781	6.872	Uldaho
Polygon	0	79251.122	1343.109	7.925	19.583	Uldaho
Polygon	0	16503.230	490.619	1.650	4.077	Uldaho
Polygon	0	8795.786	489.470	0.880	2.174	Uldaho
Polygon	0	8528.648	414.468	0.853	2.108	Uldaho
Polygon	0	43692.005	1173.105	4.369	10.796	Uldaho
Polygon	0	318102.726	2941.662	31.810	78.603	Uldaho
Polygon	0	62490.648	1299.070	6.249	15.441	Uldaho
Polygon	0	50795.913	1062.837	5.080	12.553	Bennett
Polygon	0	7737.126	345.879	0.774	1.913	Bennett
Polygon	0	43101.071	939.197	4.310	10.650	Uldaho
Polygon	0	18804.824	703.290	1.880	4.645	Hemmelman, W.
Polygon	0	20863.007	703.192	2.086	5.155	USFS
Polygon	0	38165.535	784.232	3.817	9.432	Uldaho
Polygon	0	833.507	146.749	0.083	0.205	Uldaho
Polygon	0	668613.651	5040.762	66.861	165.214	Bennett
Polygon	0	65317.797	1152.295	6.532	16.141	Uldaho
Polygon	0	25366.791	633.013	2.537	6.269	Uldaho
Polygon	0	5652.682	363.049	0.565	1.396	Bennett
Polygon	0	114864.070	1746.787	11.486	28.382	Bennett
Polygon	0	7067.843	349.931	0.707	1.747	USFS
Polygon	0	12811.087	458.899	1.281	3.165	Bennett
Polygon	0	15483.845	574.783	1.548	3.825	Hemmelman, W.
Polygon	0	2877.634	246.254	0.288	0.712	Uldaho
Polygon	0	28778.750	762.023	2.878	7.112	Roberts, B.
Polygon	0	8226.088	362.519	0.823	2.034	Bennett

UI	Bennett	Roberts	Hemmelman	USFS
291.2	297.5	15.3	8.4	6.9
47%	48%	2.5%	1.4%	1.1%

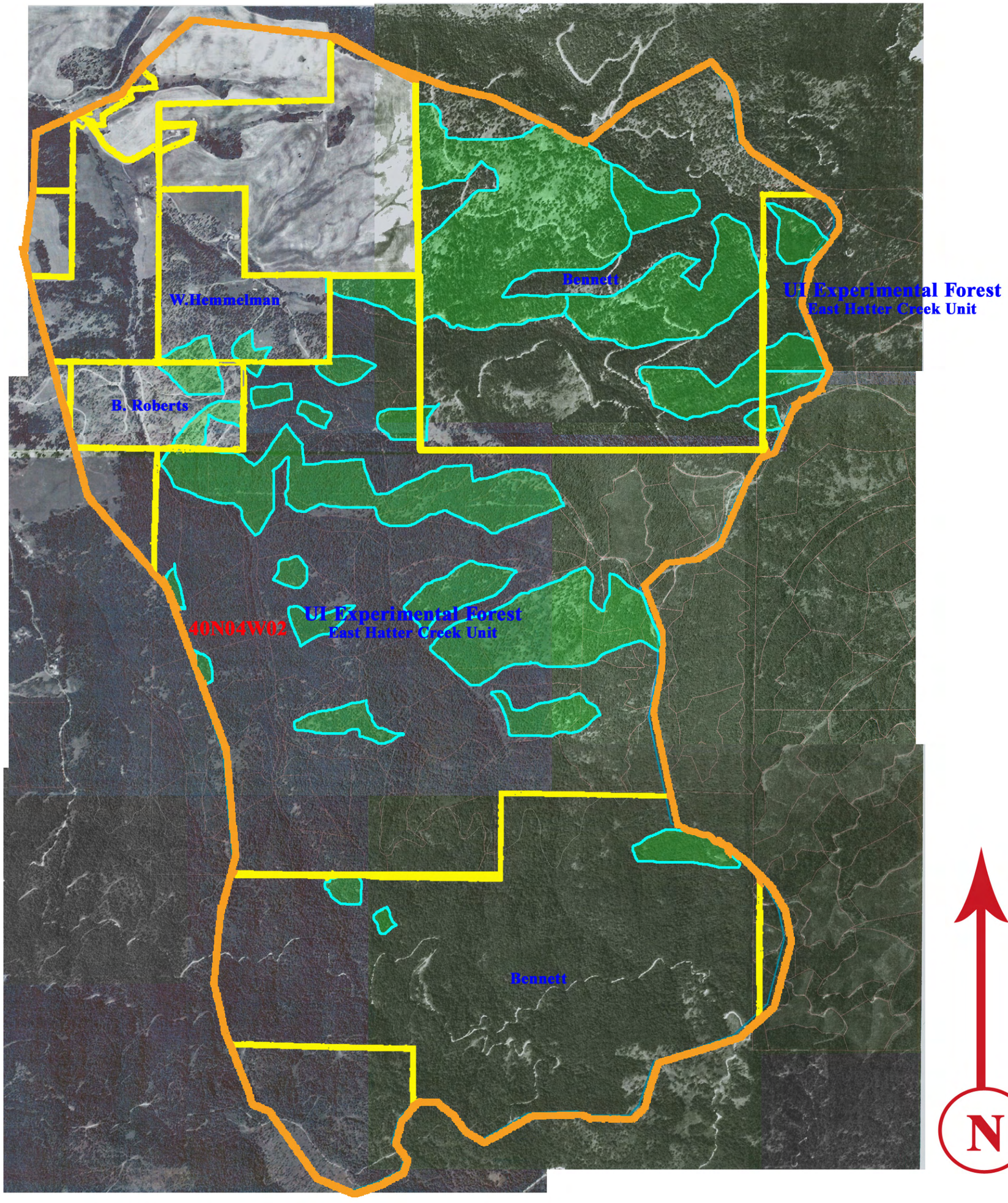
Total: 619.3

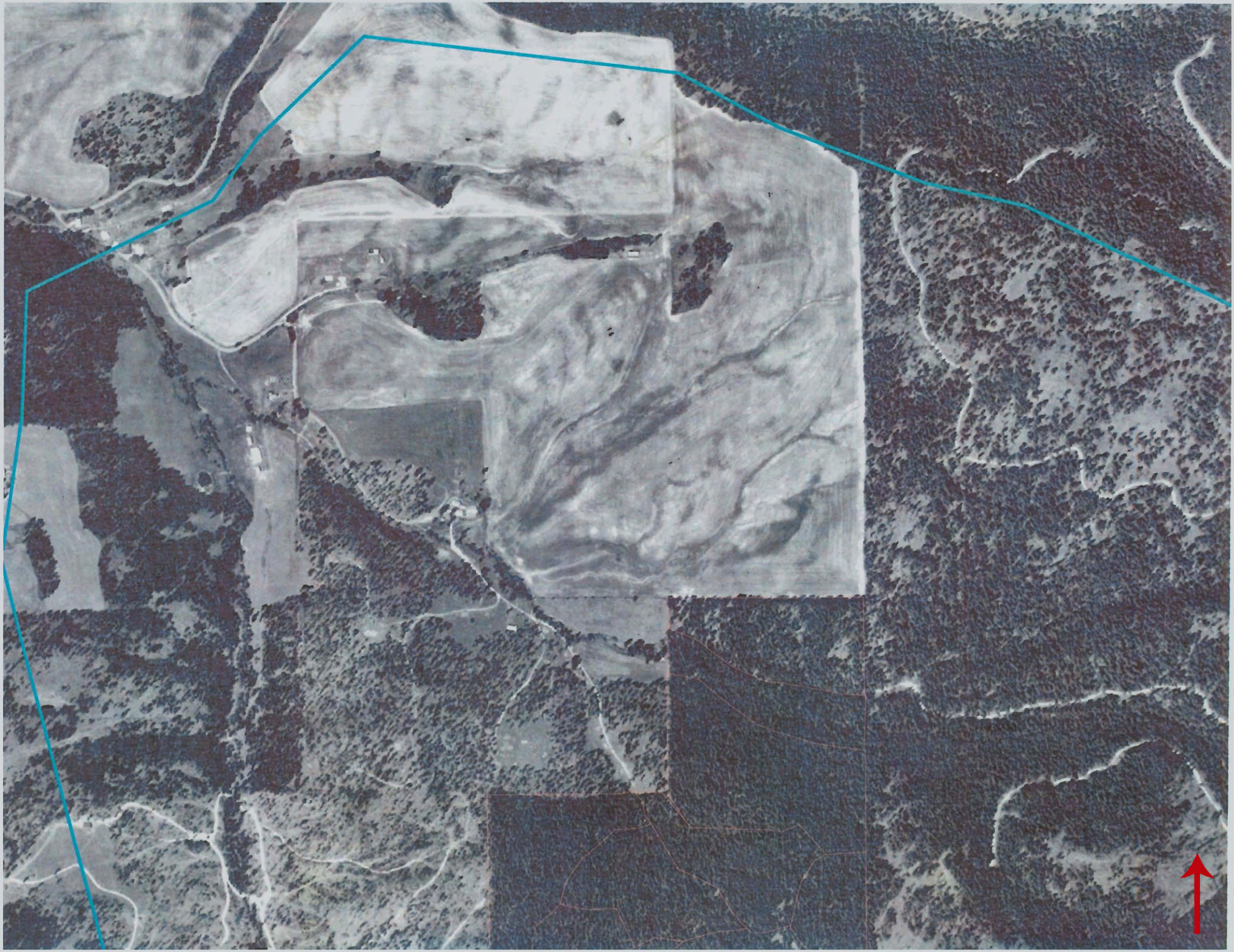
Potential

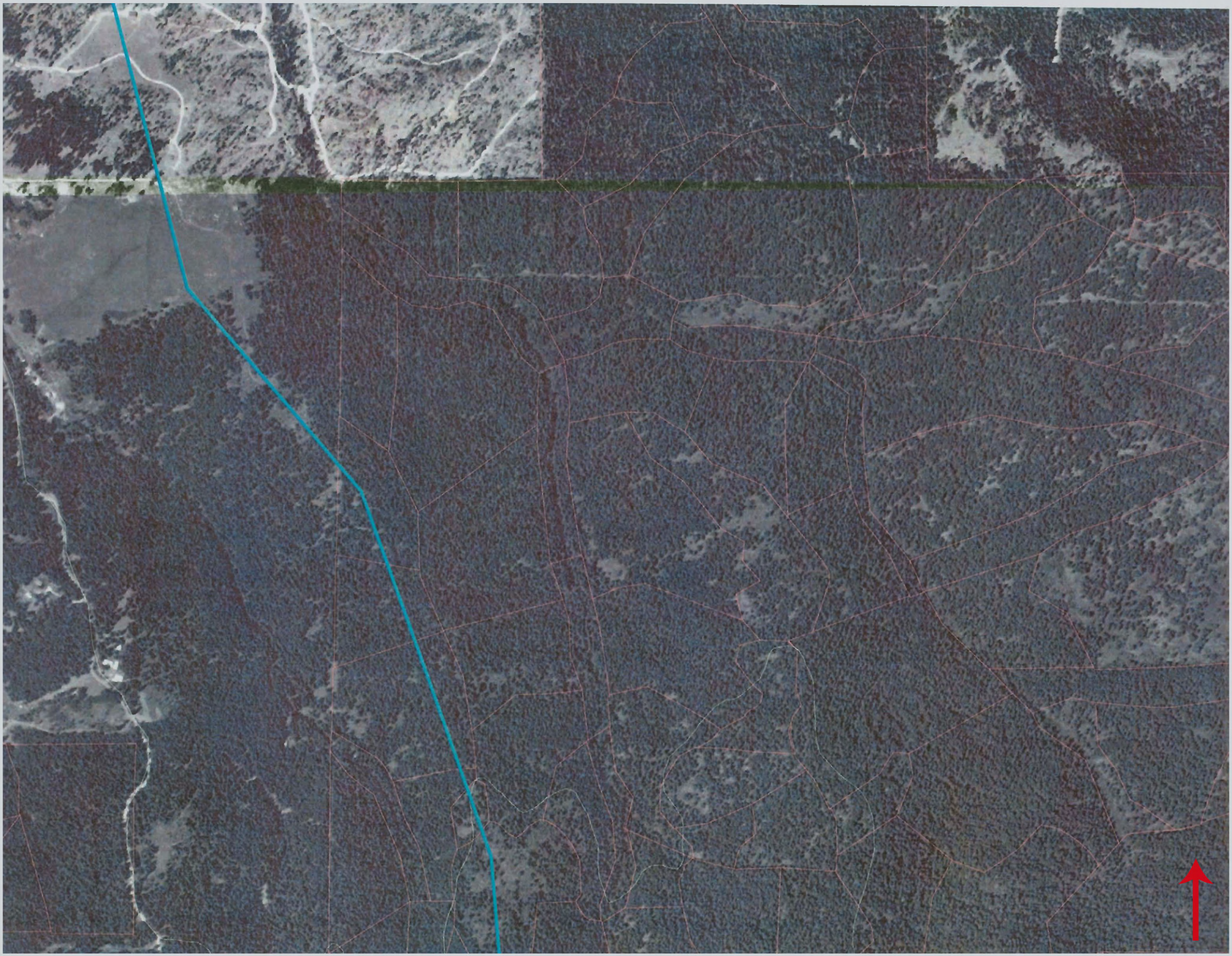


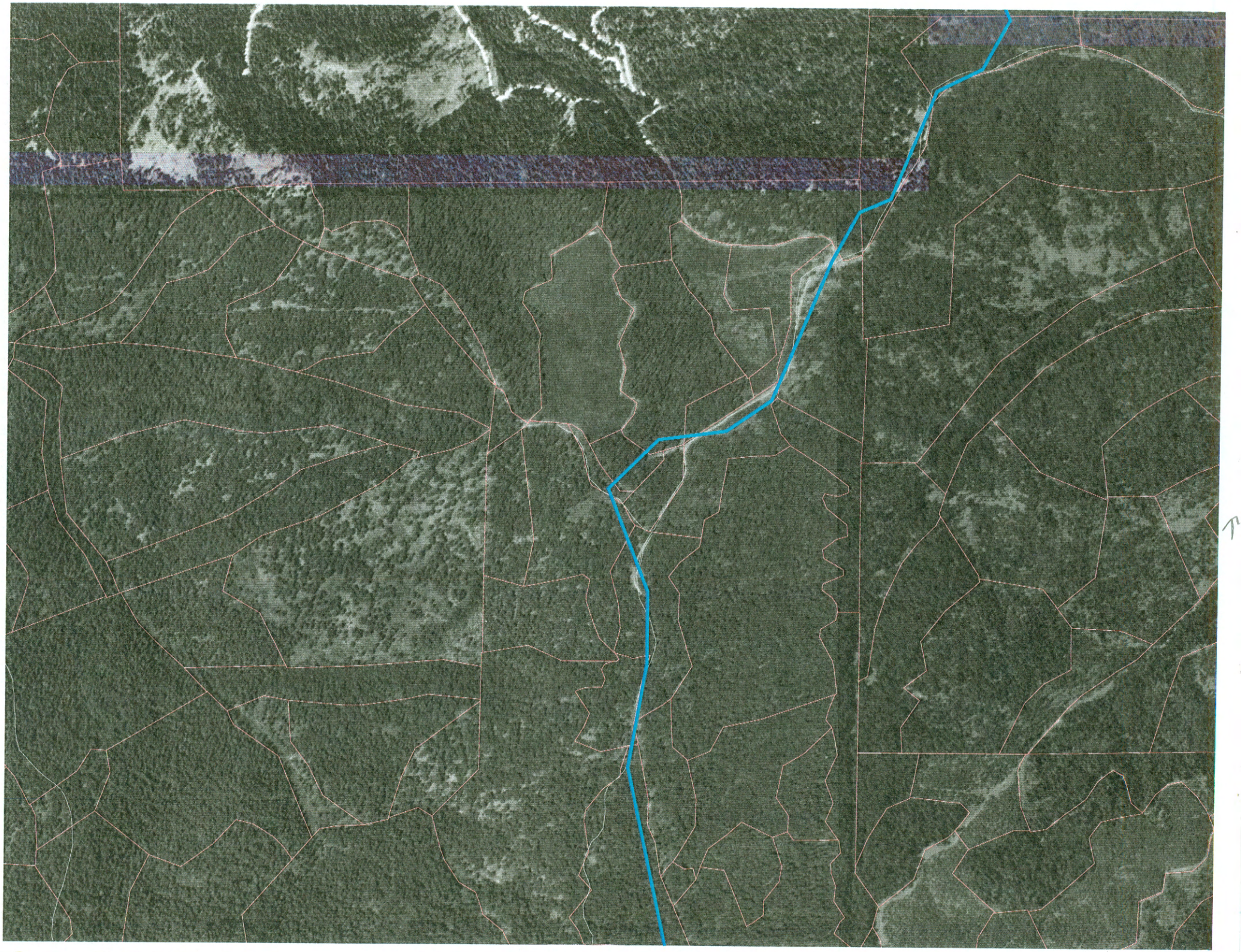
Potential Winter Range Map

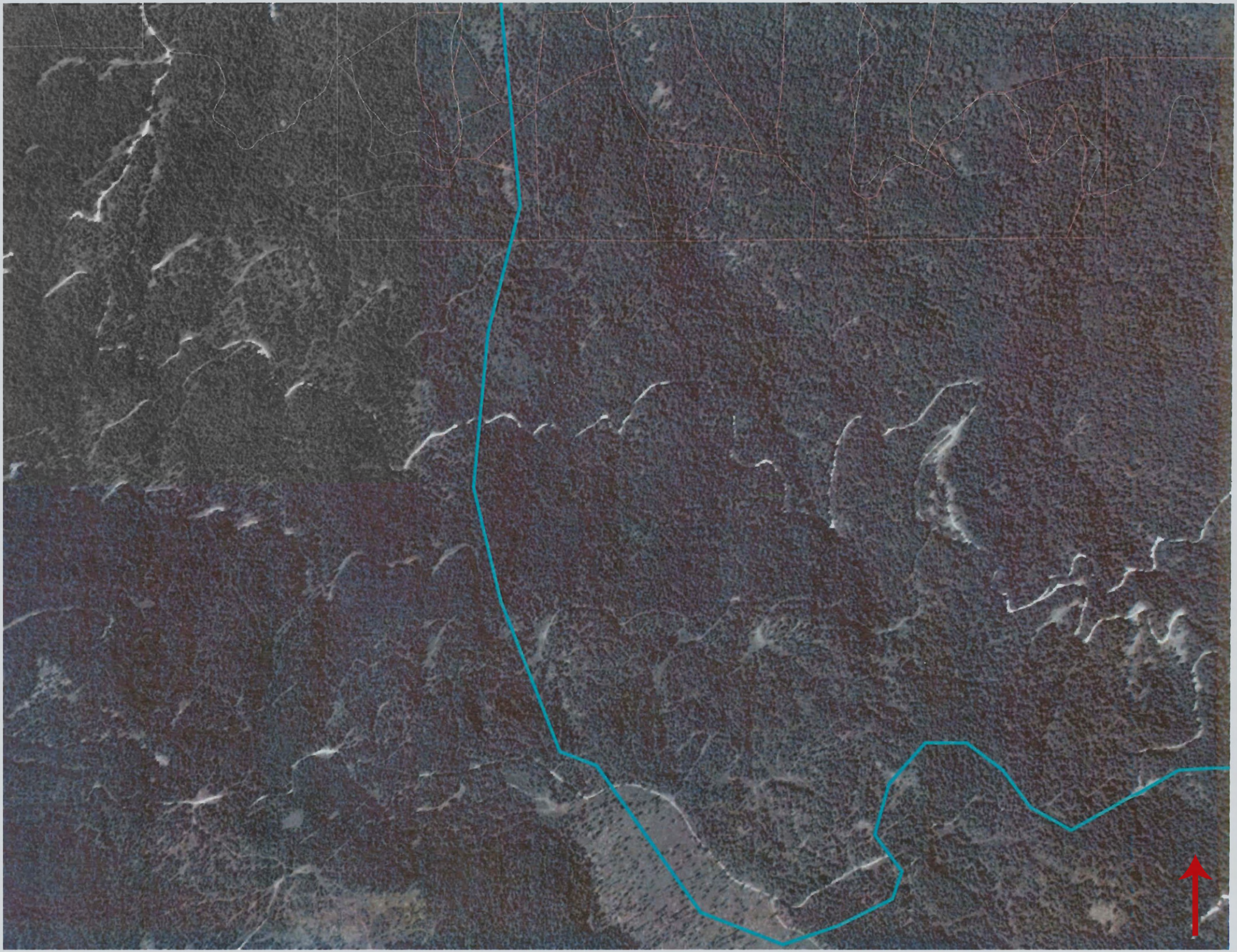
East Hatter Creek Watershed

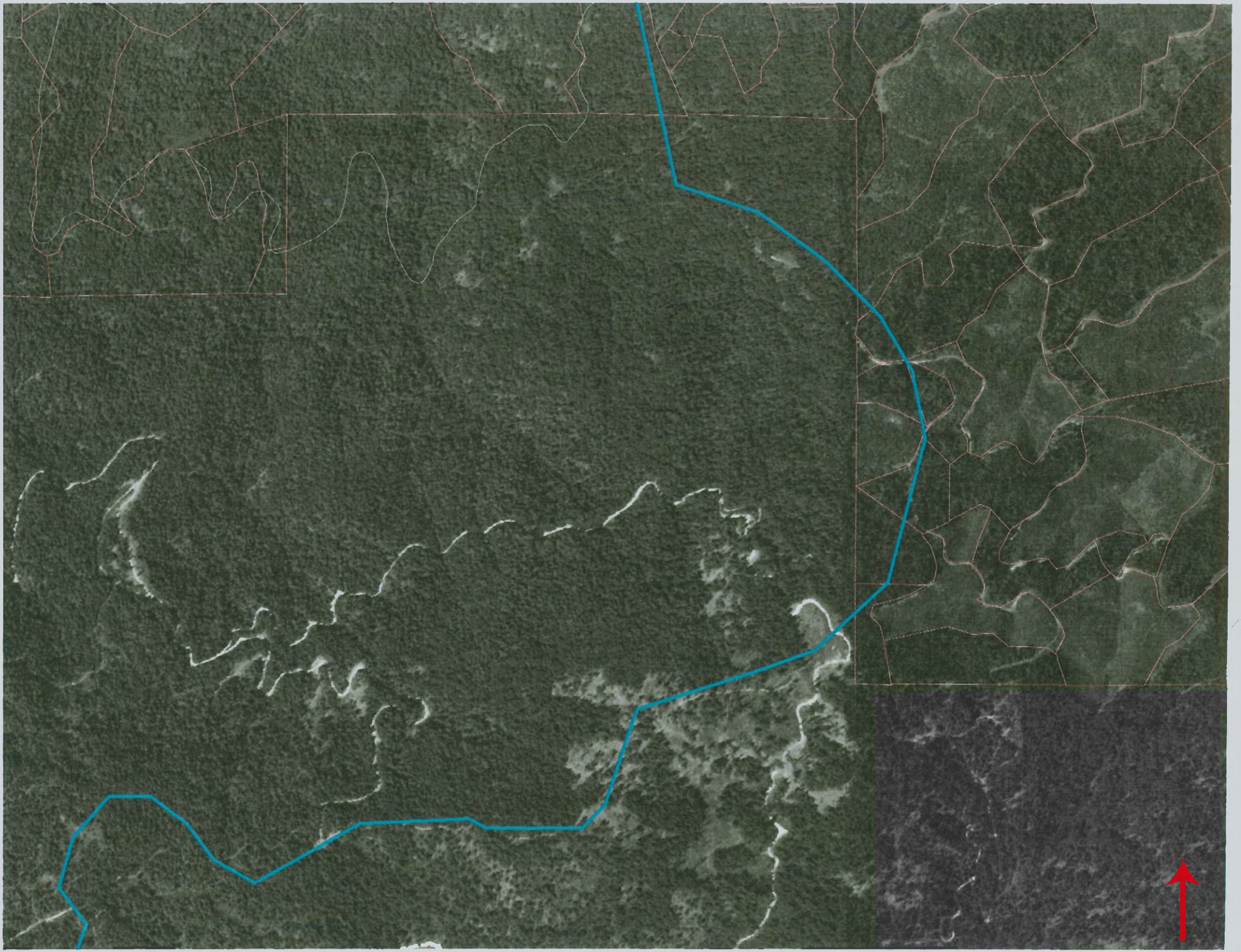


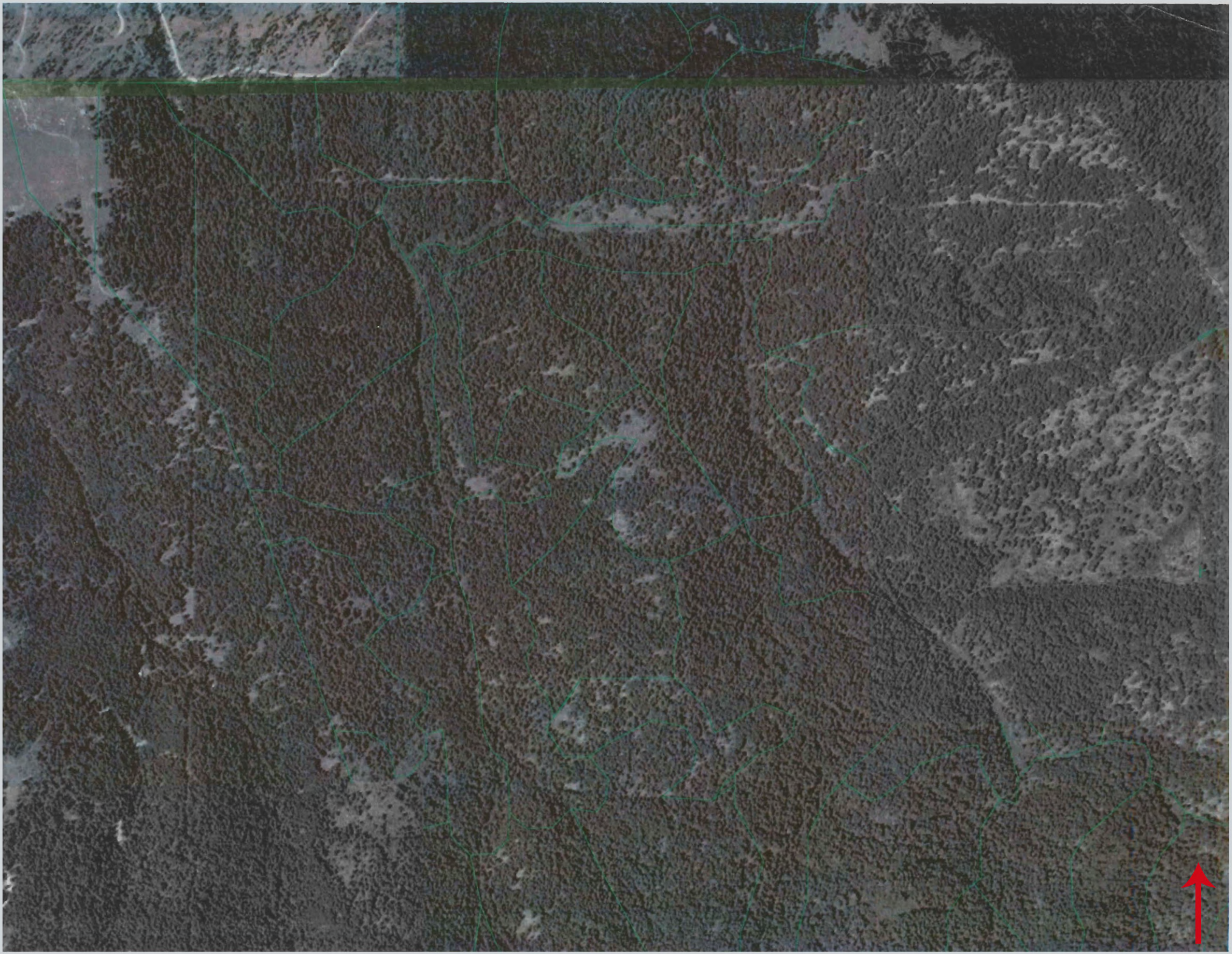


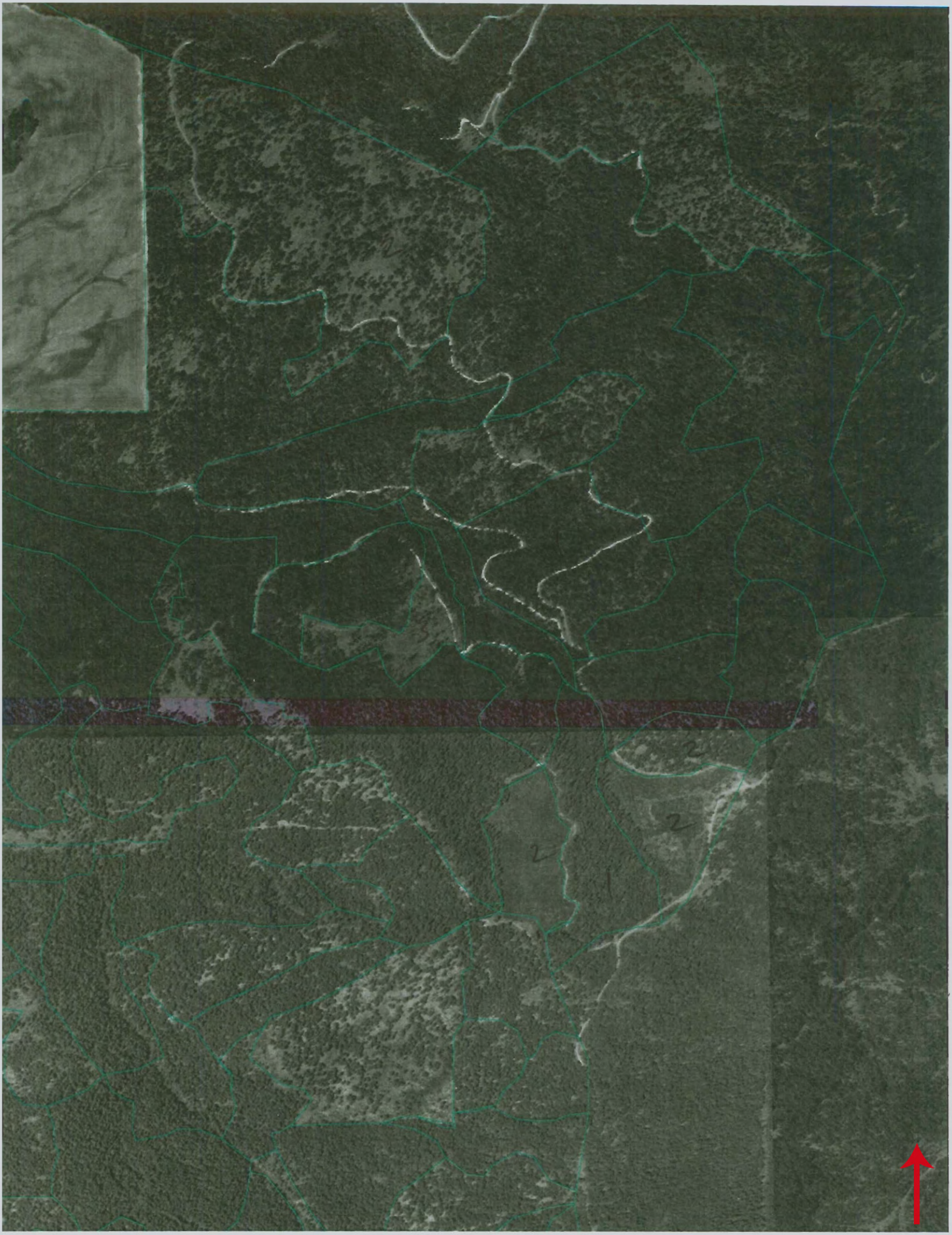


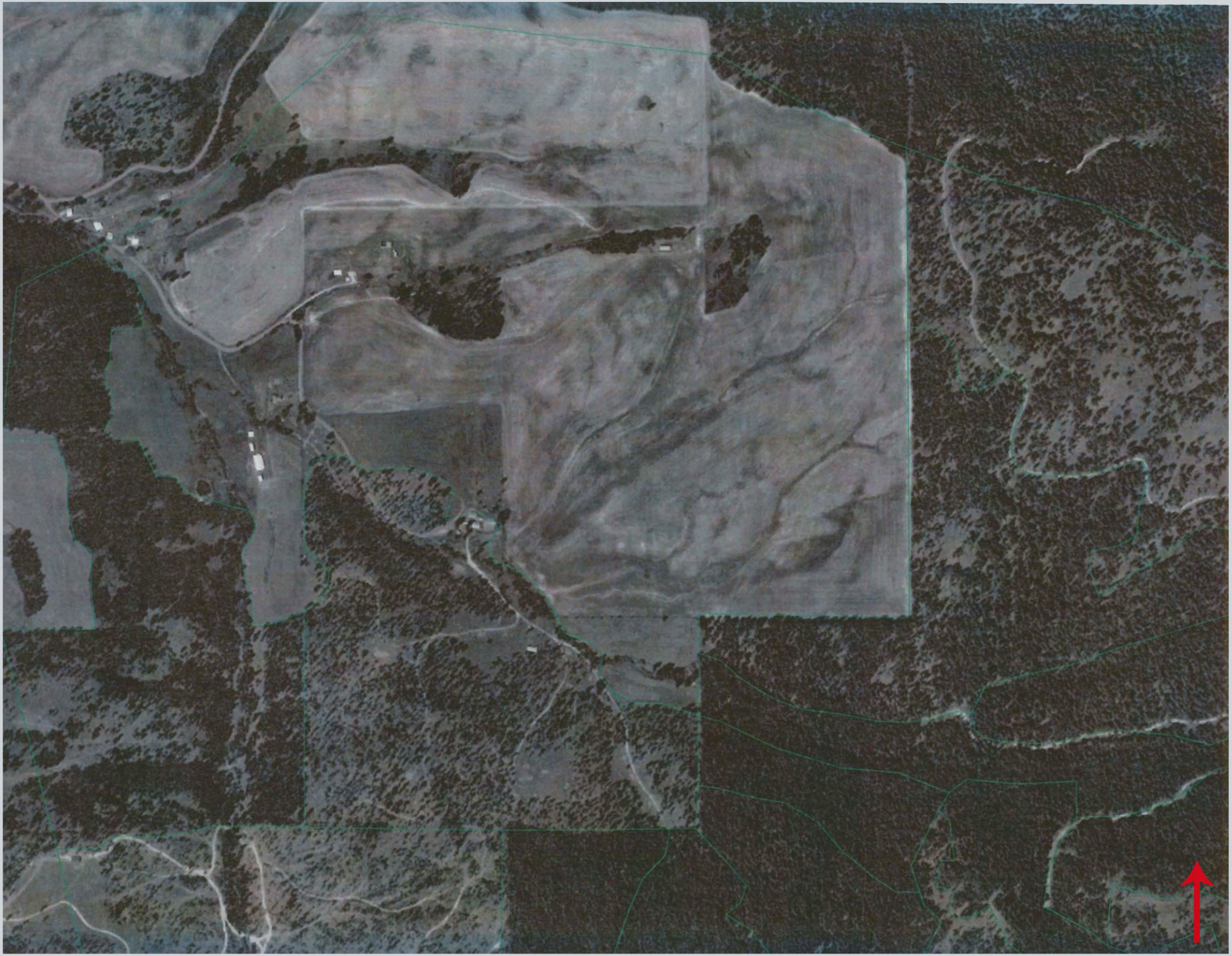




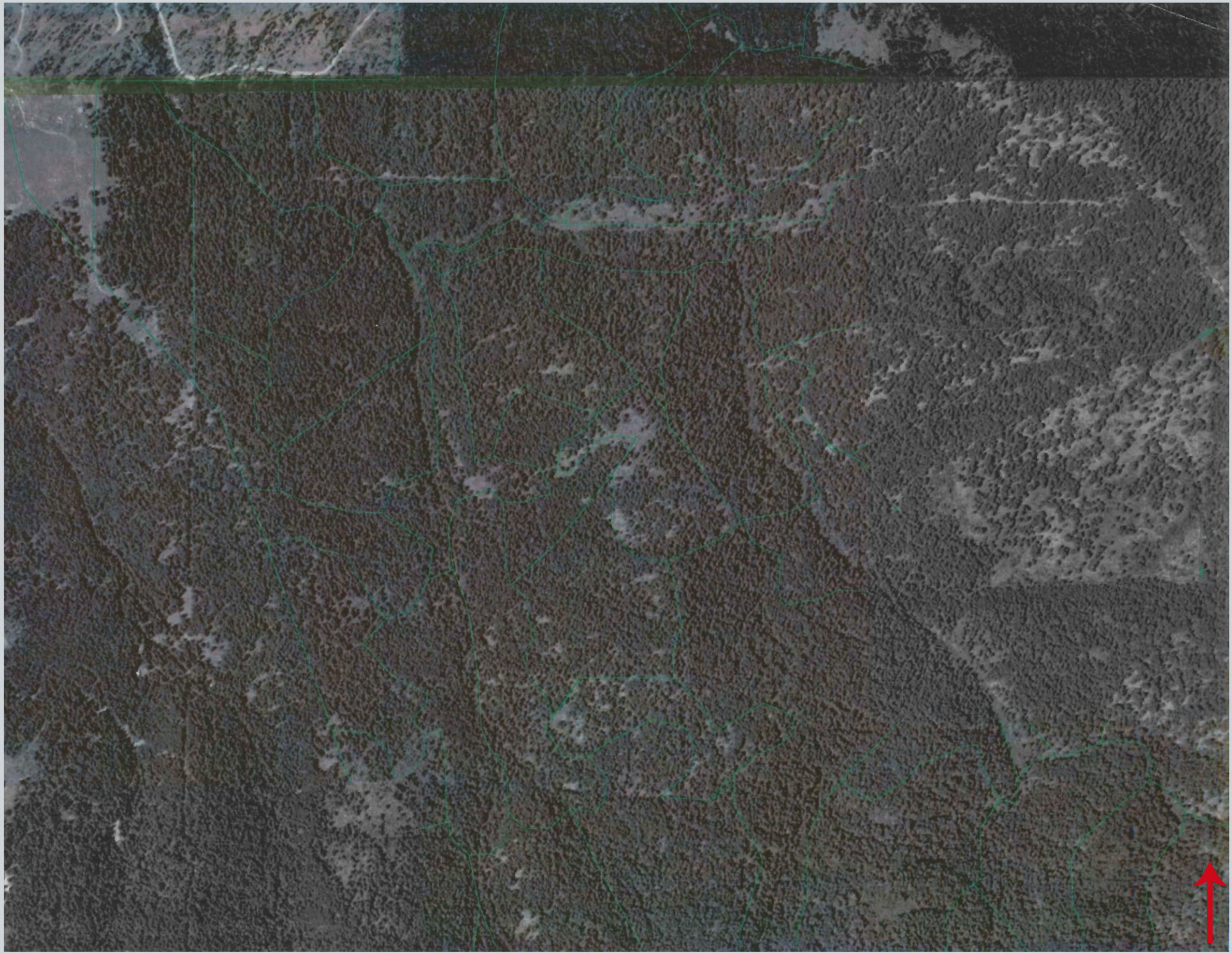




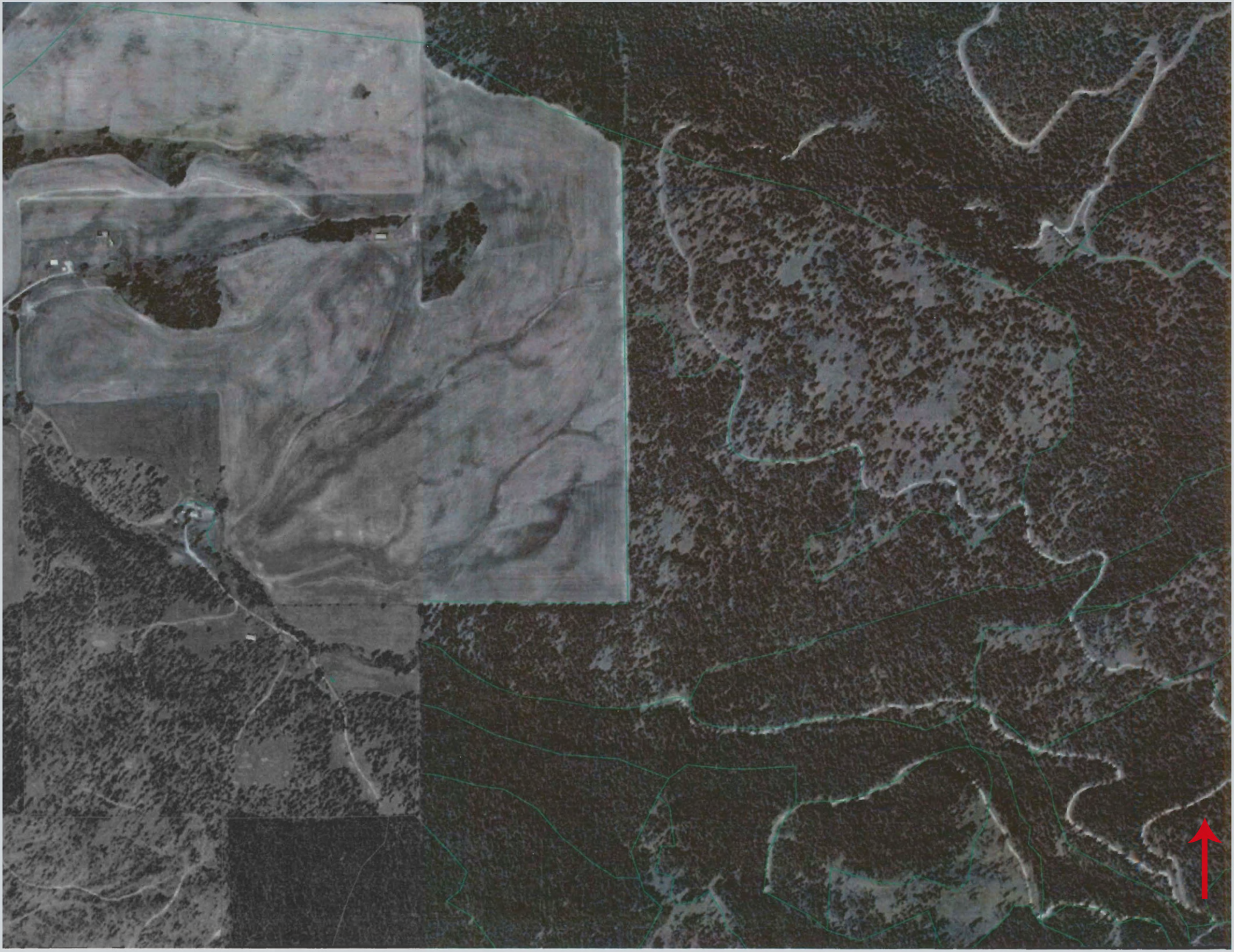

2
2
2
1

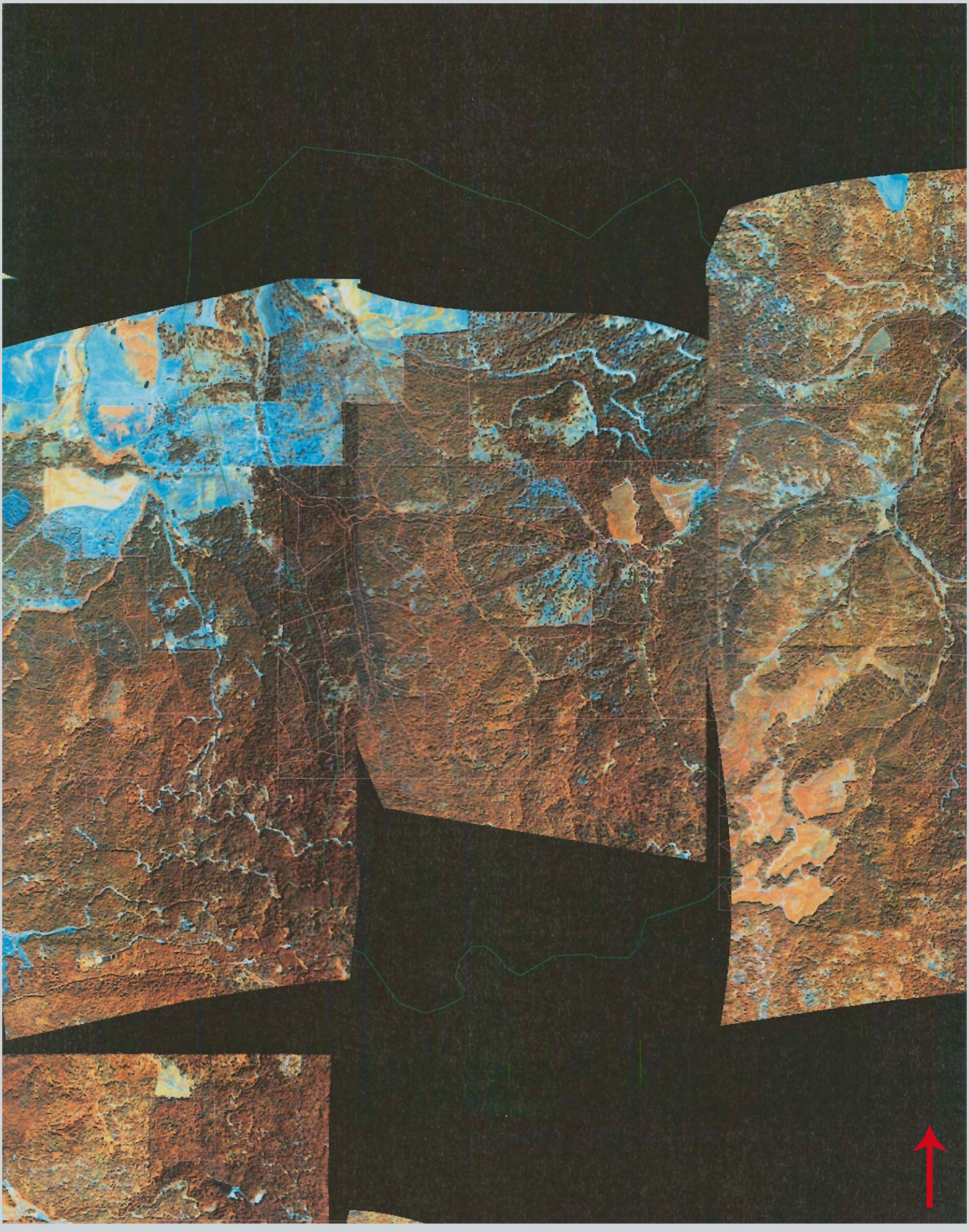


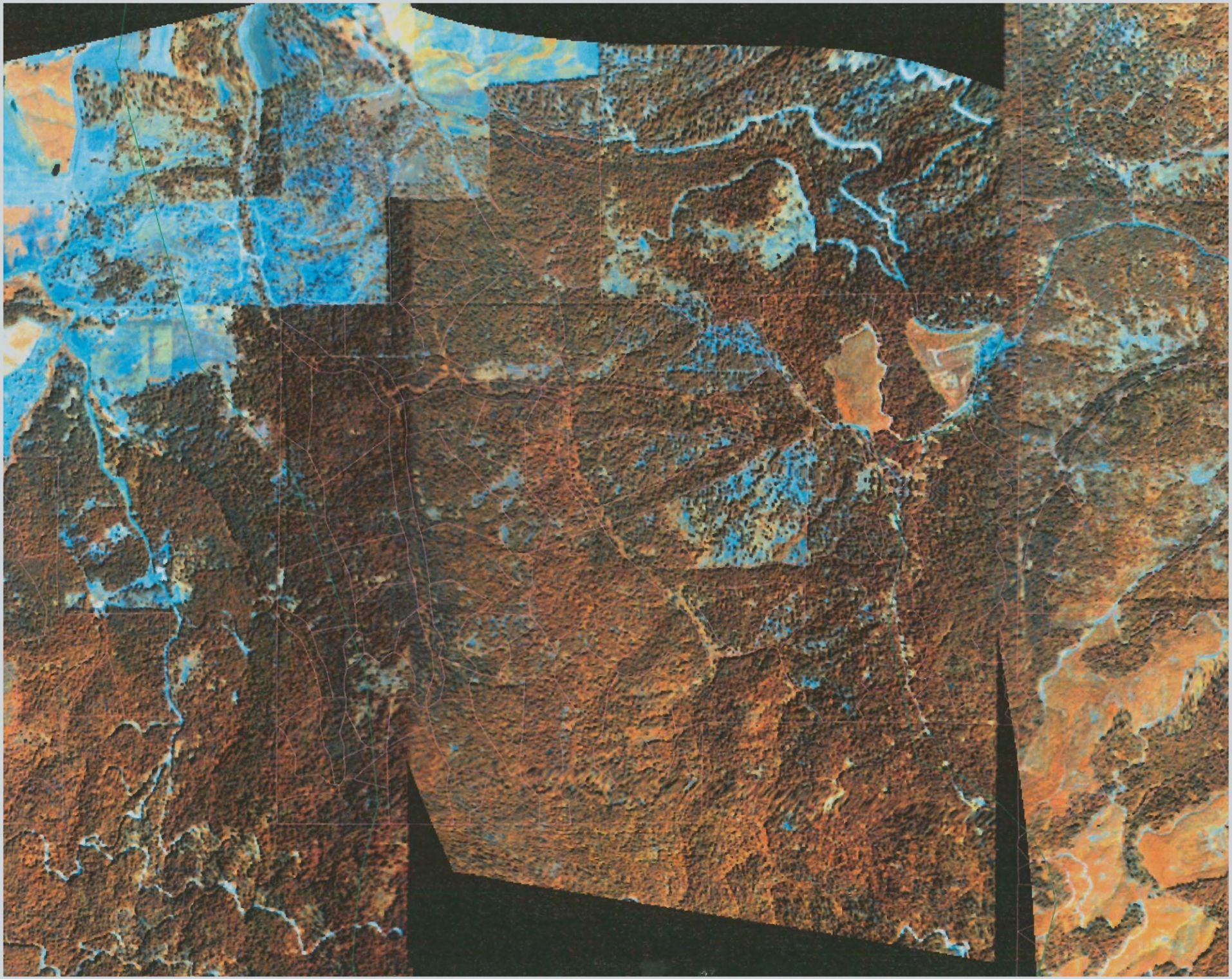
1
2
2
2
2
2
2



1
2
3







Location of Complete Research:

Author & Title: Powell, Jake

A GIS Analysis of White-Tailed Deer Winter Range in the East Hatter Creek Watershed, Idaho (1999)

University of Idaho Library:

Call Number- Not Published

College of Natural Resources

Notes: This is the complete research done by this author, his electronic GIS data files were corrupted and he was unable to restore them.