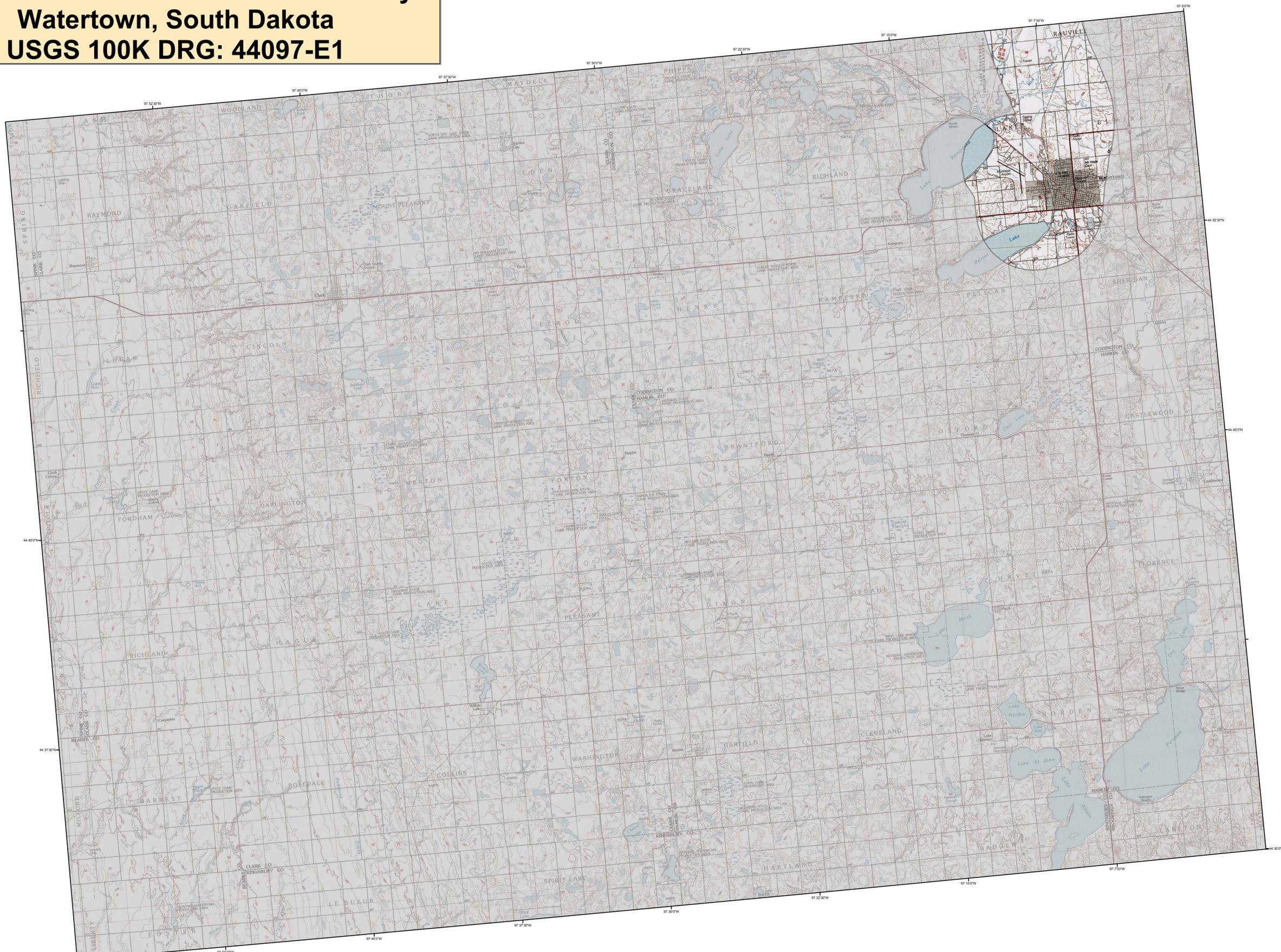


2006 Aerial Insect and Disease Survey Watertown, South Dakota USGS 100K DRG: 44097-E1



1:100,000

Legend

Code	Causal Agent	Primary Host	Code	Causal Agent	Primary Host	Code	Causal Agent	Primary Host
1	Douglas-fir beetle	Douglas-fir	40	Anisoplia	Lodgepole Pine	108	fall webworm	Cottonwood, Poplar
2	Engelmann Spruce Beetle	Engelmann Spruce	50	White pine blister rust	5-needle Pine	109	fall webworm	Cottonwood, Poplar
3	Mountain pine beetle	Ponderosa Pine	51	Dwarf mistletoe	Softwoods	110	road salt	Softwoods
4	Mountain pine beetle	Lodgepole Pine	52	Elytridemia	Ponderosa Pine	111	pinewood nematode	Spruce Pine
5	Mountain pine beetle	5-needle Pine	53	Includes #65, 66 & 69	All Tree Species	112	oak wilt	Oak
6	Western pine beetle	Ponderosa Pine	54	Air pollutants	All Tree Species	113	foliage disease	All Tree Species
7	White Fir	White Fir	55	Chemical damage	All Tree Species	114	spine ips	White Spruce
8	White Fir	Softwoods	56	Lophodermium praeclarum	Softwoods	115	anthracnose like foliar disease	Bur Oak
9	White Fir	Softwoods	57	Rhabdocline pseudotsugae	Douglas-fir	116	Diaback	All Tree Species
10	Douglas-fir engraver beetle	Softwoods	58	Lophodermium arcauata	Softwoods	117	Diaback	All Tree Species
11	Western balsam bark beetle	Lodgepole Pine	59	Lecanotia acicola	Softwoods	118	Mortality	All Tree Species
12	Unidentified bark beetle	Softwoods	60	Lophodermium concolor	Softwoods	119	Flagging	All Tree Species
13	Pine engraver	Lodgepole Pine	61	Duthiersia aim	Softwoods	120	aspen tortrix	Quaking Aspen
14	Pine engraver	Ponderosa Pine	62	Needle cast (Hypodermataceae)	Softwoods	121	Marsippos Blight	Quaking Aspen
15	Ponderosa pine needle miner	Lodgepole Pine	63	Root Rot	All Tree Species	122	Diaback (ash)	Ash
16	Ponderosa pine needle miner	Ponderosa Pine	64	Unidentified disease	All Tree Species	200	Diaback (cottonwood)	Cottonwood, Poplar
17	Jack pine budworm	Jack Pine	65	Winter damage light	All Tree Species	202	Diaback (hardwood)	Hardwoods
18	Spruce budworm, light defol.	Douglas-fir	66	Winter damage medium	All Tree Species	204	Diaback (oak)	Oak
19	Spruce budworm, medium defol.	Douglas-fir	67	Winter damage heavy	All Tree Species	210	Mortality (oak)	Oak
20	Spruce budworm, heavy defol.	Douglas-fir	68	Diplolepis	Softwoods	211	Mortality (eastern cedar)	Eastern Red Cedar
21	Douglas-fir tussock moth	Douglas-fir	69	Pinus black stain	Common Pinon	212	Mortality (hardwood)	Spruce
22	Pine butterfly	Ponderosa Pine	70	Fire	All Tree Species	213	Mortality (oak)	Oak
23	Pine looper	Ponderosa Pine	71	Phytophthora	All Tree Species	214	Mortality (spruce)	Spruce
24	Leaf miner	Hardwoods	72	Winter damage	All Tree Species	220	Discoloration (ash)	Ash
25	Leaf miner	Hardwoods	73	High water damage	All Tree Species	221	Discoloration (cottonwood)	Softwoods
26	Pine needle-shaft miner	Ponderosa Pine	74	Avallanche	All Tree Species	222	Discoloration (eastern cedar)	Eastern Red Cedar
27	Pine sawflies	Ponderosa Pine	75	Aspen decline-multiple agent(s)	Quaking Aspen	224	Discoloration (hardwood)	Hardwoods
28	Variable oak leaf caterpillar	Hardwoods	76	Pinus pine mortality	Common Pinon	225	Discoloration (spruce)	Spruce
29	Unidentified defoliator	All Tree Species	77	Juniper mortality-unknown agent(s)	Juniper	226	Discoloration (cottonwood)	Cottonwood, Poplar
30	Heterosidation annosum (Fomes annosus)	Softwoods	78	Quercus oak decline-unknown agent(s)	Quaking Oak	231	Harblite (eastern cedar)	Eastern Red Cedar
31	Amelara caryocarpae (Amelara meles)	Softwoods	79	Lumber pine decline-multiple agent(s)	Lumber Pine	240	Mortality (hardwood)	Hardwoods
32	Polygonus schweinitzi	Softwoods	80	Hail damage	All Tree Species	242	Unidentified defoliator (cottonwood)	Cottonwood, Poplar
33	Phonopora	Softwoods	81	Unknown polygon	Common Pinon	250	Unidentified defoliator (elm)	Elm
34	Cytospora	All Tree Species	82	Old pinon mortality	Lodgepole Pine	251	Unidentified defoliator (hardwood)	Hardwoods
35	Western gall rust	Unknown	83	Old pine mortality	Lodgepole Pine	252	Mortality (spruce)	Softwoods
36	Coniostoma rust	Unknown	84	Old pine mortality	Lodgepole Pine	300	Mortality (spruce)	Softwoods
37	Shabalinia rust	Lodgepole Pine	85	Old pine mortality	Lodgepole Pine			

USGS 100K Quad - Location Map



How Aerial Surveys Are Conducted

Data represented on this map are based on aerial observations manually recorded onto a map. This procedure is considered both an art form and a form of scientific data collection, and is highly subjective. An observer only has a few seconds to recognize the color difference between healthy and damaged trees of different species; diagnose causal agents correctly; estimate intensity; delineate the extent of damage; and precisely record this information on a georeferenced map. Air turbulence, cloud shadows, distance from aircraft, haze, smoke, and observer experience can all affect the quality of the survey. These data summaries provide an estimate of conditions on the ground and may differ from estimates derived by other methods.

Aerial surveys provide information on the current status for many causal agents, and are important when examining insect activity trends by comparing historical and current survey data over large areas.

Overview surveys are a snap shot in time and therefore may not be timed to accurately capture the true extent or severity of a particular disturbance activity. Aerial surveys can be thought of as the first stage in a multi-stage sampling design. Other remote sensing approaches, including aerial photography, electro-optical sensors, and specially designed aerial surveys with modified flight patterns, can be used to more accurately delineate the extent and severity of a particular disturbance agent. The preceding methods are often more costly than overview surveys, and are generally reserved to address situations of sufficient environmental, economic, or political importance.

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****DISCLAIMER****
Due to the nature of aerial surveys, the data on this map will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented on this map because these agents are not detectable from aerial surveys. The data presented on this map should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and causal agent. Shaded areas show locations where tree mortality or defoliation were apparent from the air. Intensity of damage is variable and not all trees in shaded areas are dead or defoliated.

Area surveyed by Bill Schaupp & Al Dymerski 07/11/2006
Map Created: 01/19/2007
Projection: UTM NAD83 Zone 13
Author: J. Ross, USDA Forest Service

A data dictionary and digital copies of this map and the insect and disease data are available at: <http://www.fs.fed.us/r2/resources/fhm/aerialsurvey/>