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THE LOOPER (GEOMETRID CATERPILLARS) OUTBREAK OF 1976

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EXTENT OF DAMAGE

On June 21, 1976 a blight of the mountain shrub zone on Wetherill Mesa and neighboring mesas on both sides was reported. On examining the area I found complete defoliation of serviceberry and partial defoliation of other associated mountain shrubs. The infested area reaches from 7400' to 8000' and apparently to the crest of Wild Horse Mesa on the west, across Wetherill Mesa, to the crest of Long Mesa on the east and around the spur east of Long Mesa toward the north. The included short spurious inter-mesas on the north and the canyon slopes are also infested. About 600 acres are affected. The main portion is devastated with respect to the dominant species and appears as if the bushes never leafed out. The boundaries are fairly clear cut though there is some fringe affect on closer examination. On the north and south fringe not all bushes of serviceberry are noticeably affected and some are only partially defoliated. Here the shrubs of second favor are not as readily attacked. On the eastern boundary there are several small isolated patches or stringers of infestation. One such stringer, east of Long Mesa on a spur, follows a neck of serviceberry which reaches north between two cliffhouse sandstone outcroppings. More specifically the damaged area includes the following, as noted on June 22:

0.2 miles south of north rim overlook on Wetherill Mesa and extending 2.0 miles down mesa from this point; this fringes out on a narrow part of the mesa about 0.7 miles north of the dense pinyon-juniper line. The devastation extends further south of this point on Wildhorse Mesa for approximately another three-quarters mile. It also extends further north on Wildhorse Mesa, almost to the north rim on the slopes. On Long Mesa the devastation reaches south only about 1.5 miles from the north rim.

At this time it appears that the peak of infestation is well past and there is no indication of further spread.

On June 23 I set up a study plot to be monitored for an indefinite time, particularly checking vegetation recovery and insect recurrence in future years. This plot, 200 feet by 200 feet, is 1.0 mile south of north rim overlook at the head of Wetherill Mesa.

GEOMETRIDAE DESCRIPTION

The defoliating agent is a larval form of Geometridae. The larvae of this family are commonly called looper, cankerworm, measuring worm, inch worm, or spanner. When outbreaks of epidemic proportions of these insects occur, the result is often complete defoliation of a species or in extreme cases of all plant species in an area. Although a looper infestation in a conifer forest may result in defoliation and eventual mortality of the trees, broad leafed trees and shrubs usually recover after defoliation.

The Wetherill outbreak may be of the spring cankerworm or looper, Palaocrita vernata, but a positive identification has not been made. The caterpillars are smooth, nearly hairless, with three pairs of true legs in front, the mid portion of the body being free of appendages, and in this species with two pair of prolegs on the rear of the abdomen. The fall looper has three pair of prolegs. The characteristic mode of travel accounts for the several common names of these caterpillars. They move along by grasping with the hind pairs of prolegs while they loop the body forward, then holding with the front legs while they hump their back to bring up their rear. When alarmed individuals of this species of Geometridae will drop from the bush into mid air where they swing at the end of a long silk thread spun from the mouth. After danger has passed, they ascend the thread by twisting their head over and winding the thread around the hind thoracic legs. I also noted this thread as a means of transference between bushes.

The looper on Wetherill is ventrally light greenish yellow, dorsally brown with darkened areas at each segment, and laterally appear to have a fine black line. Their head is russet brown and so is their caudal segment, making it difficult to tell heads from tails.

The adult moths of this family are medium sized, slight bodied and gray colored with a zig zag wing pattern. They held their wings horizontal when at rest.

LIFE HISTORY

The eggs of the spring loopers are oval and are laid singly or in irregular masses in the crevices or under the bark scales on the limbs and trunks of the food trees or shrubs in the spring. The loopers feed on the leaves and flowers usually through May and June. As the larvae mature they drop to the ground where they pupate and pass the winter. The pupae are naked, that is, without a cocoon, and are covered by a black, glossy, hard skin. In March, April, and May the adults emerge and lay their eggs. The females of the spring looper are wingless and this probably accounts for the localization of an outbreak.

DESCRIPTION OF INFESTED AREA

The following species were used as food plants in order of apparent descending preference.

SERVICEBERRY - Amalanchier utahensis

- 100% defoliation of each shrub, except on the fringes.
- 100% of the shrubs are utilized except on fringes.
- the dominant shrub in infected area (highest relative frequency and density).

MOUNTAIN MAHOGANY - Cercocarpus montanus

- 50-100% defoliation of each shrub.
- about 50% of the shrubs are utilized.
- this shrub has low frequency (about 5%) in infected area.

OAK - Quercus gambelii

- 100% defoliation of the utilized shrubs.
- less than 50% of the shrubs are utilized.
- shrubs in mesic sites under rimrocks, in alcoves and in drainage bottoms were noninfested.

ANTELOPE BITTERBRUSH - Purshia tridentata

- about 50% defoliation of most of these shrubs.
- 80-100% of the shrubs show early use, they have a thick entanglement of webbing, and were apparently abandoned during the feeding period. The bitterbrush leafs out earliest of all the associated shrubs and it may serve as a temporary food until the serviceberry foliage is available.
- a shrub of minor density because it is heavily browsed and occurs only on the mesa tops and not on the canyon slopes.

SNOWBERRY - Symphoricarpus oreophilus

- less than 10% defoliation of each shrub.
- about 75% of the shrubs show a minor amount of use; the subshrubs under the larger serviceberry and oak are lightly fed on, probably during the course of travel between preferred species. The subshrubs in the open and under Fendler generally show no damage.
- a shrub of high frequency and minor density.

FENDLERBRUSH - Fendlera rupicola

- only one specimen with partially eaten leaves was detected (may not be looper damage).
- a fairly common shrub on the canyon slopes.

HORSEBRUSH - Tetradymia canescens

- no looper damage.
- occasional occurrence in the infested area.

RABBITBRUSH - Chrysanthamnus nauseosus

- no looper damage.
- occurs only along road or other disturbed sites.

In most cases the entire leaf was destroyed. Mats of dried serviceberry leaf scraps entangled in webbing cling to the bushes or are blown to the ground. In the case of oak often the main veination remains, apparently too sclerous for the looper to bite into and in a few cases of serviceberry this main vein remains. Some of the serviceberry terminal buds have been deeply eaten and these may not be able to recover. Most of the bitterbrush leaves are eaten only on the top ends.

The multitude of webs and apparent early abandonment of the bitterbrush may indicate that the eggs were laid on the plant. I have not located any eggs of the looper at this time.

Loopers of the same species were also seen on Aster biglovii and Artemesia ludoviciana but there was no apparent feeding on these plants. This siting was on plants near the base of a mountain mahogany and the caterpillars may have been in transit.

In the laboratory I placed fifteen loopers in the middle of a box and placed serviceberry, mountain mahogany, and bitterbrush each in a different corner and about six inches from the center. Nine of the loopers went to the serviceberry and settled to feed, five to the mountain mahogany and one to the bitterbrush. The consumption rate of serviceberry per looper was a fourth to a half of a leaf in a twelve hour period. By June 28 the larvae had all submerged into the dirt in the box and transformed into the pupal stage.

As my observations in the field were near the close of the larval, feeding stage, I was able to find only one bush (a mountain mahogany near the north end of the mesa) with a fully active population. This bush was uniformly covered with loopers at about 40 to 50 loopers per foot of leafed limb.

At the north end of Chapin Mesa and along the north rim between Long Mesa and Chapin are zones of predominant serviceberry but these have no infestation. The limited and localized area of infestation may be explained by the relative nonmobile apterous female moth. Looper outbreaks have been reported to build up for a three year period until natural controls, as disease, predators, and parasites, bring them under control.

The infested area will have a definite affect on deer browsing as winter forage species have been reduced. The deer will undoubtedly put a little more pressure on the rest of the Mesa Verde range but in general the browse plants are in a healthy condition. The only possible exception is antelope bitterbrush which is largely eaten to under a foot in height and much of each years new growth is taken. This is true on Wetherill Mesa in the looper infested area and I have noted it on the north end of Chapin.

NATURAL CHECKS AT WORK

Birds:

Birds seem to be the most important enemies of the loopers. During the week of June 21 I noted the following birds in the infested area:

- Sparrow hawk (these eat large amounts of insects)
- Scrub jay
- Magpie (audible observation only)
- Chickadee
- White breasted nuthatch
- House wren
- Hermit thrush
- Mountain bluebird, male & female
- Western bluebird
- Gray vireo
- Western tanager
- Spotted towhee
- Green sided towhee
- Pipit or vesper sparrow

A swift was seen sweeping under the north rim but not in the infested area and these would feed only on the adult flying Geometrids. No flocking birds were in the area during this time. All of the above, with the exception of the scrub jay, are insect eaters and many of the above were seen feeding among the bushes. The scrub jay, of the Corvidae family, like other members of this family, is probably omnivorous when the occasion arises. The birds were active in the morning, one time even in a brisk cool wind, and especially after a shower. Birds were seen and heard at every observation stop that I made and were common in flight and perching in the fire snags along the road. The mountain bluebirds and green sided towhees were seen in mating flight and it is likely that the area serves as a nesting site.

In the northeast fringe of the infested area are several small looper outbreaks (about one quarter acre large). These small areas had no remaining loopers on June 23 and the foliage of the serviceberry bushes is only partially eaten. The bird numbers in the sheltered canyon head alcoves is fairly high and it is conceivable that the loopers were held in check or eliminated by the birds.

Insect Parasites:

In my limited observation devoted to examining associated insects I saw several ichneumonid wasps and one braconid wasp. These both, when in the larval stage, parasitize other insects and they are both regarded as important controls of various lepidopterous outbreaks.

The female wasp lays her eggs in or on the caterpillar or the moth. The host may be paralyzed or killed at the time of oviposition. Often the host, if a larva at the time it is parasitized, will continue to develop into a pupa. The wasp egg hatches into a larva which then feeds on the caterpillar. Since the life cycle of the braconids can be completed in three to four weeks and the female lays as many as 500 eggs, this wasp has the potential to increase proportionate to abundant host material. I suspect that more intensive and earlier observation would have yielded more evidence of insect parasitism and predation.

Disease:

A polyhedral viral disease has been introduced into some looper outbreaks when the infested tree is of economic importance. I collected several dead immature caterpillars to be sent off for further examination. The carcasses are dried, dark brown, shriveled, and clinging to the limb with the prolegs and in a reared position. These were not found in enough abundance to have been consequential to the dissemination of this particular looper attack.

OTHER CONTROLS:

Sticky bands can be used to bar the movement of the crawling female moth. Also creosote or calcium cyanide may be spread or poured along the path of movement.

Severe looper outbreaks in trees of economic importance have warranted control by plane spraying. One pound of DDT in a gallon of fuel oil is applied. Other sprays are three pounds of powdered arsenate of lead to 100 gallons of water and one part of 40% nicotine sulfate to 1000 parts of water.

Heavy storms after adult emergence and before egg laying also checks an epidemic.

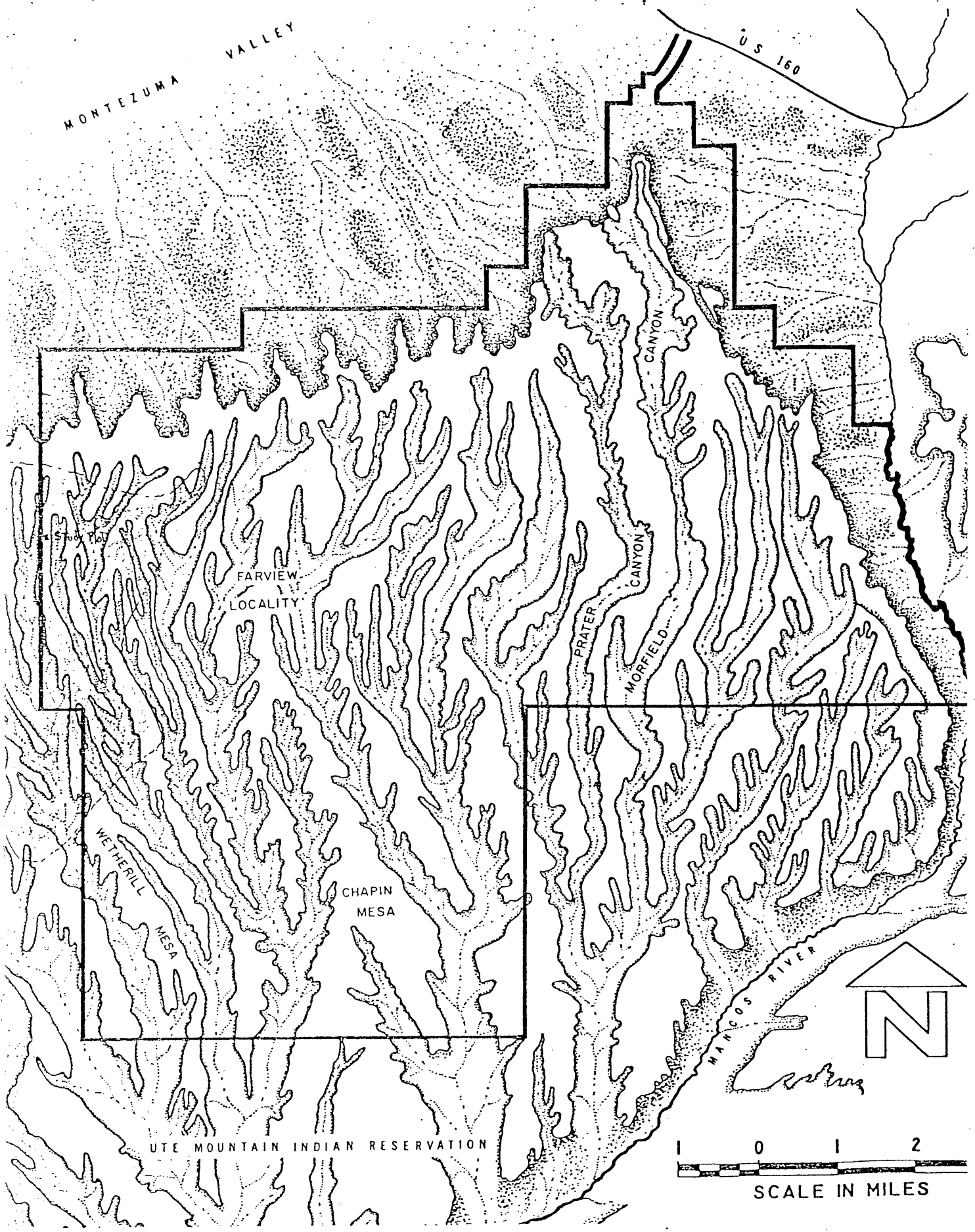
It will be next spring before it can be determined if natural checks, especially the birds, as well as spring storms will reduce the population of loopers on Wetherill Mesa. Toxic chemicals would not be recommended at this time.

VEGETATION RECOVERY - Study Plot:

On June 21, 1976 the shrubs were brown in general appearance, some had very tiny green terminal buds, and others had been eaten several millimeters deep into the terminal end of this years growth, the remaining stems were green and alive around the cambium zone. The exception to this was the antelope bitterbrush which had been in recovery for some time. Some bitterbrush had leaves nearly full grown. Others had stunted or scattered leaves but were lightly foliated.

On June 23 some serviceberry bushes had thinly scattered new leaves 1.5 cm long. Some serviceberry still showed only green terminal buds and some still had no signs of recovery. At this date I took the following data from the study plot set up on Wetherill Mesa. The plot is one mile south of the north rim overlook, on the east side of the road about 100 feet off of the road. The main plot is 200 feet by 200 feet, divided into four subplots (100 ft by 100 ft) two subplots are on the mesa tops and two subplots are over the slope to the east; all are connected. The corners are marked with 3/4" reinforcing rods painted fluorescent orange.

Sam Tanner, an interpretive ranger, reports that this area was denuded, appearing as if frozen, when he was there June 1st.



NORTH MESA SUBPLOT

June 23, 1976

	Number of Bushes	100% Initial Damage	50% Foliage Destruct.	-10% Foliage Destruct.	1.0 - 10.0 mm New Terminal Growth	10.0 - 25.0 mm New Terminal Growth	25.0 + mm New Terminal Growth	% of Individ. Limbs/ Bush Recov.
Serviceberry 4'-6' tall	16	16			Ca 50%	Ca 5%		Too early
2'-4' tall	4	4			Ca 50%			Too early
Mtn. Mahogany 6' tall	1	1			ca 50%			Too early
Fendlera 4'-6' tall	2	No damage						
Bitterbrush 2'-4' tall	3		3		90-100%			90-100%
0'-2' tall	15		15		90-100%			90-100%
Snowberry 2'-4' tall	33			33	Damage so light no stimulation for new growth			
Oak	None occurring							
Horsebrush 0'-2' tall	1	No damage						

SOUTH MESA SUBPLOT

June 23, 1976

Serviceberry 6' + tall	3	3			ca 50%	Ca 5%		Too early
4'-6' tall	16	16			ca 50%	Ca 5%		Too early
2'-4' tall	1	1			ca 50%			Too early
0'-2' tall	2	2			ca 50%			Too early
Mtn. Mahogany	None occurring							
Fendlera 6' + tall	4	No damage						
4'-6' tall	3	No damage						
2'-4' tall	11	No damage						
Bitterbrush 0'-2' tall	10		8		90-100%			90-100%
Snowberry 2'-4' tall	32			32	Damage so light no stimulation for new growth			
Oak	None occurring							
Horsebrush 0'-2' tall	None occurring							

NORTH SLOPE SUBPLOT

	Number of Bushes	100% Initial Damage	50% Foliage Destruct.	-10% Foliage Destruct.	1.0 - 10.0 mm New Terminal Growth	10.0 - 25.0 mm New Terminal Growth	25.0 + mm New Terminal Growth	% of Individ. Limbs/ Bush Recov.
Serviceberry								
6' + tall	1	1			ca 50%	ca 5%		Too early
4'-6' tall	8	8			ca 50%	ca 5%		Too early
2'-4' tall	5	5			ca 50%			Too early
0'-2' tall	2	2			ca 50%			Too early
Mtn. Mahogany								
2'-4' tall	1			1	ca 10%			
Fendlera								
6' + tall	3	No damage						
4'-6' tall	11	No damage						
2'-4' tall	3	No damage						
Bitterbrush	None occurring							
Snowberry								
0'-2' tall	10			10	Damage so light no stimulation			
Oak								
4'-6' tall	1	1			ca 50%			too early
Horsebrush	None occurring							

SOUTH SLOPE SUBPLOT

Serviceberry								
6' + tall	1	1			ca 50%			Too early
4'-6' tall	8	8			ca 50%			Too early
2'-4' tall	1	1			ca 50%			Too early
Mtn. Mahogany								
6' + tall	2	2			ca 50%			Too early
Fendlera								
6' + tall	3	No damage						
4'-6' tall	8	No damage						
2'-4' tall	2	No damage						
0'-2' tall	2	No damage						
Oak								
6' + tall	8	8			ca 50%			Too early
4'-6' tall	1	1			ca 50%			Too early
2'-4' tall	1	1			ca 50%			Too early
0'-2' tall	1	1			ca 50%			Too early
Snowberry								
0'-2' tall	23			23				
Horsebrush	None occurring							
Bitterbrush								
0'-2' tall	3		3		90-100%			90-100%

FOLLOW-UP OBSERVATIONS OF LOOPER DAMAGED AREA

July 1st, 1976

Some dead wood of this years growth can be ascertained now, especially in cases where the terminal buds had been deeply eaten.

Some new serviceberry leaves have obovate tips and lack the serration, probably as a result of being eaten off during the bud stage.

The new growth has an average of three leaves per terminal bud whereas the original spring growth was four to six leaves per terminal bud.

About one-third of the bushes show little recovery and still appear in dead condition or with very few scattered leaves.

About one-third have 1.0 to 2.5 cm leaves, in early recovery stage, scattered recovery.

About one-third have 2.5 to 3.5 cm leaves, in good recovery, generally overall.

Only one looper was found in the area, on a newly leafed out serviceberry. The caterpillar was alive but lethargic.

Many birds were still in the area and were active among the bushes.

Ron Crawford reported two large flocks of birds on July 1st on Wetherill Mesa. One flock was near the water tank and the other was near Rock Springs. Ron did not make a positive identification of the dark colored, sparrow sized birds but some accounts report of large blackbird flocks completely eliminating looper outbreaks.

NORTH MESA SUBPLOT

	Number of Bushes	100% Initial Damage	50% Foliage Destruct.	-10% Foliage Destruct.	1.0 - 10.0 mm New Terminal Growth	10.0 - 25.0 mm New Terminal Growth	25.0 + mm New Terminal Growth	% of Individ. Limbs/ Bush Recov.
July 4, 1976								
Serviceberry 4'-6' tall	16	16			4	9	3	10-70%
2'-4' tall	4	4					4	10-70%
Mtn. Mahogany 6' tall	1	1				1		50%
Fendlera 4'-6' tall	2	No damage						
Bitterbrush 2'-4' tall	3		3		3	One bush at 75% broken limbs the rest have started & scattered limbs		
0'-2' tall	15		15		15			
Snowberry 2'-4' tall	33			33	No change			
Oak	None occurring							
Horsebrush 0'-2' tall	1	No damage						

SOUTH MESA SUBPLOT

July 4, 1976								
Serviceberry 6' + tall	3	3				3		10-90%
4'-6' tall	16	16			1	7	8	10-90%
2'-4' tall	1	1					1	10-90%
0'-2' tall	2	2				2		10-90%
Mtn. Mahogany	No occurring							
Fendlera 6' + tall	4	No damage						
4'-6' tall	3	No damage						
2'-4' tall	11	No damage						
Bitterbrush 0'-2' tall	10		10		No change			
Snowberry 2'-4' tall	32			32	No change			
Oak	None occurring							
Horsebrush 0'-2' tall	None occurring							

NORTH SLOPE SUBPLOT

July 2, 1976

	Number of Bushes	100% Initial Damage	50% Foliage Destruct.	-10% Foliage Destruct.	1.0 - 10.0 mm New Terminal Growth	10.0 - 25.0 mm New Terminal Growth	25.0 + mm New Terminal Growth	% of Individ. Limbs/ Bush Recov.
serviceberry								
6' + tall	1	1				1		10-90%
4'-6' tall	8	8			2	4		10-90%
2'-4' tall	5	5				1	2	10-90%
0'-2' tall	2	2			1	1	4	10-90%
tn.Mahogany								
2'-4' tall	1		1		1			40%
endlera								
6' + tall	3	No damage						
4'-6' tall	11	No damage						
2'-4' tall	3	No damage						
itterbrush	None occurring							
nowberry								
0'-2' tall	10			10	No change			
ak								
4'-6' tall	1	1					(35.0 mm) 1	75%
orsebrush								

SOUTH SLOPE SUBPLOT

July 2, 1976

serviceberry								
6' + tall	1	1				1		90%
4'-6' tall	8	8			2	4	2	90%
2'-4' tall	1	1			1			90%
tn.Mahogany								
6' + tall	2	2				2		90%
endlera								
6' + tall	3	3	No change					
4'-6' tall	8	8	No change					
2'-4' tall	2	2	No change					
0'-2' tall	2	2	No change					
ak								
6' + tall	8	8					8	50-75%
4'-6' tall	1	1					1	90%
2'-4' tall	1	1			1			10%
0'-2' tall	1	1			1			10%
nowberry								
0'-2' tall	23			23	No change			
orsebrush	None occurring							
itterbrush								
0'-2' tall	3		3		3			50%

FOLLOW-UP OBSERVATIONS OF LOOPER DAMAGED AREA

July 30, 1976

Rebuilding of some of the shrubs began almost immediately after the defoliation. The process toward refoliation seemed to accelerate after several summer rains (totaling 2.29 inches during July on Chapin Mesa at 7100 ft). By the end of July the new leaves were full grown except for a few immature serviceberry leaves and a few red tainted, immature oak leaves.

The serviceberry bushes in the overall view of the area, especially on the slopes, still appear distinctly gray. For unknown reasons the mesa serviceberry bushes had a better recovery than the slope bushes, though all appeared equally damaged in the initial stages. The mesa bushes averaged a 90% recovery while the slope bushes averaged 50% recovery, with some having only 30% recovery. Some bushes have entirely dead limbs with scaling bark but these have presumably been dead for a year or more, perhaps from tent caterpillar activity.

One large serviceberry bush on the mesa has almost 100% recovery of full sized leaves. Most bushes on the mesa top, however, lack recovery on some (about 10%) small twigs which had deeply eaten buds. In about half of the specimens the leaves are smaller and with obtunded apical ends.

Most of the bitterbrush shows improvement such as increased leaf growth and new leaves.

The mountain mahogany of the south slope subplot have dry and curled leaves. No blighting agents can be detected and this condition may be due to the extreme aridity during the early refoliation.

The snowberry bushes which were slightly damaged now have healed, brown rimmed leaves but no new growth.

No looper larvae remain in the area. In a few cases the new leaves have secondary but minor insect damage such as leaf miner tunnels and unidentified perforations.

The roots of the shrub species of this community, except possibly snowberry, are extremely tenacious—much more so than evergreen tree species which often die after two or three consecutive years of looper attack. Scrub oak has been known to revive from the root system after the above ground parts had been nearly denuded for over 60 years by continual goat grazing. Serviceberry and mountain mahogany at Mesa Verde live under the pinyon-juniper canopy, in an etiolated condition, but when released by fire, the shrubs assume full form within a few years.

NORTH MESA SUBPLOT

	Number of Bushes	100% Initial Damage	50% Foliage Destruct.	-10% Foliage Destruct.	1.0 - 10.0 mm New Terminal Growth	10.0 - 25.0 mm New Terminal Growth	25.0 + mm New Terminal Growth	% of Individ. Limbs/ Bush Recov.
<i>July 30, 1976</i> Serviceberry 4'-6' tall	16	16			3	10	3	90%
2'-4' tall	4	4				3	1	20-90%
Mtn. Mahogany 6' tall	1	1				1		90%
Fendlera 4'-6' tall	2	No damage						
Bitterbrush 2'-4' tall	3		3		3		{ new leaves	80%
0'-2' tall	15		15		10	5	{ new growth	20-80%
Snowberry 2'-4' tall	33			33	No change except leaves dead			
Oak	No occurring							
Horsebrush 0'-2' tall	1	No damage						

SOUTH MESA SUBPLOT

<i>July 30, 1976</i> Serviceberry 6' + tall	3	3			1	3	8	
4'-6' tall	16	16				7	1	
2'-4' tall	1	1						
0'-2' tall	2	2				2		
Mtn. Mahogany	None occurring							
Fendlera 6' + tall	4	No damage						
4'-6' tall	3	No damage						
2'-4' tall	11	No damage						
Bitterbrush 0'-2' tall	10		10			10	{ new leaves + new growth	80%
Snowberry 2'-4' tall	32			32	No change except leaves dead			
Oak	None occurring							
Horsebrush 0'-2' tall	None occurring							

NORTH SLOPE SUBPLOT

	Number of Bushes	100% Initial Damage	50% Foliage Destruct.	-10% Foliage Destruct.	1.0 - 10.0 mm New Terminal Growth	10.0 - 25.0 mm New Terminal Growth	25.0 + mm New Terminal Growth	% of Individ. Limbs/ Bush Recov.
July 30, 1976								
Serviceberry								
6' + tall	1	1				1		70%
4'-6' tall	8	8				6		50-70%
2'-4' tall	5	5				1	2	30-50%
0'-2' tall	2	2			1		4	30-50%
Mtn. Mahogany								
2'-4' tall	1		1			1		40%
Fendlera								
6' + tall	3	No damage						
4'-6' tall	11	No damage						
2'-4' tall	3	No damage						
Bitterbrush	None occurring							
Snowberry								
0'-2' tall	10			10	No change, Rolled leaves (50 mm)			
Oak								
4'-6' tall	1	1					1	80%
Horsebrush								

SOUTH SLOPE SUBPLOT

SOUTH SLOPE SUBPLOT

July 30, 1976								
Serviceberry								
6' + tall	1	1				1		40%
4'-6' tall	8	8				8		40%
2'-4' tall	1	1			1			40%
Mtn. Mahogany								
6' + tall	2	2				2		50%
Fendlera								
6' + tall	No damage							
4'-6' tall	No damage							
2'-4' tall	No damage							
0'-2' tall	No damage							
Oak								
6' + tall	8	8					8	90%
4'-6' tall	1	1					1	90%
2'-4' tall	1	1				1		10%
0'-2' tall	1	1			1			15%
Snowberry								
0'-2' tall	23			23	No change, horked leaves			
Horsebrush	None occurring							
Bitterbrush								
0'-2' tall	3		3		3			50%

LOOPER FOLLOW-UP - 1979

Wetherill Mesa, 6-27-79

NO INFECTION OF LOOPERS this year.

5% of the serviceberry and oak show affects of 1976 - 77 damage.

Interior portions of limbs have no leaves; only tips alive.

In rare incidences 60 - 70% of the limbs are dead full length.

TENT CATERPILLARS

At heads of both forks of Long Canyon and Wickiup Canyon.

Many limbs (5 to 10 per bush) of serviceberry are dead on the ends when tent caterpillars were in previous years.

Concentration of damage is in 90% of the bushes in draw heads (where protected from spring winds?).

