Observations of Arthropod Populations Following the La Mesa Fire of 1977[1]

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Abstract.—Sampling sites were selected in burned and unburned areas where transects for bird surveys had previously been established. Plots were selected randomly in each site and sampled weekly. A 50 m^2 plot was selected in a severely burned area and an unburned area nearby and observations made on arthropod populations. There were more genera collected in the unburned than the burned areas. Generally, the most common arthropods found in burned and unburned areas were ants and spiders. A New Jersey light trap operated at Ponderosa campground in 1977, before the fire, collected several hundred specimens per trap night. In 1978, the volume of specimens collected in the trap was similar to that collected before the fire. In some areas the drastic reduction in arthropod populations might have had an adverse effect on populations of some insectivorous birds or other animals.

INTRODUCTION

On June 16, 1977, the La Mesa Fire started adjacent to Bandelier National Monument, New Mexico and subsequently swept through a large part of the Monument. The progress of the fire and its ecological aftermath have been extensively documented, providing a framework for investigating fire effects upon arthropod populations.

A general inventory of arthropods that occur on Bandelier had been initiated in May 1977 as part of the VIP program of the NPS. Approximately one month after the fire, it was decided to sample arthropod populations in burned and unburned areas of the Monument, in an effort to document changes, if any, in genus composition and to some extent numbers. Collections were largely confined to macrofauna of the Class Insecta.

MATERIALS AND METHODS

Sampling sites were selected in areas where permanent transects for bird surveys had previously been established by Roland Wauer. These areas are: Frijoles Mesa, pinyon-juniper woodlands; Burnt Mesa, ponderosa-pinyon-juniper woodlands; Escobas Mesa, ponderosa forest; Apache Mesa, pine-fir-aspen forest; and Frijoles Canyon, riparian habitat (1/2 mile below Upper Crossing).

To sample the arthropod populations in the selected burned and unburned sites, a metal frame was constructed that was large enough to cover an area 1/2 × 1 m. The frame was then thrown in a random manner so it fell within the sample site. The area within the frame was then examined for approximately 15 minutes and all observed arthropods collected and placed in collecting vials containing 70% alcohol. Any flying insects that landed in the sample area were stunned with a fly swatter and collected. The frame was then flipped to cover another 1/2 m and the process repeated. The total area covered for each sample was then 1 sq. meter. Five such paired samples were taken from each site on a weekly basis from July 18–August 26, 1977. Vials containing the samples were labeled and returned to the laboratory for sorting, counting and shipment to specialists for generic determination.

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[1] *Technical editor's note: This paper was presented at the original La Mesa Fire Symposium in October, 1981, and was inadvertently omitted from that symposium proceedings. It is included here to make its findings more generally available.*

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Approximately 10 days after the fire was brought under control the principal author, while in a volunteer status, selected two 50 m square plots for observation and collection of arthropod specimens. One plot was in a severely burned area of ponderosa pine-scrub oak near Ponderosa Campground and the other in a similar unburned area approximately $^{1}/_{2}$ mile down the fire road toward Frijoles Canyon from Ponderosa Campground. Specimens were collected with a standard insect collecting net and by physical examination of the plots. Collections were made in July 1977 and July 1978.

It was intended to use a 12 volt battery-operated UV light trap in the transect sampling sites in 1977, but unfortunately none became available. A 110 volt New Jersey light trap, borrowed from the U.S. Air Force, was operated 3 nights per week at Ponderosa Campground from May 18–June 24, 1977, prior to the fire and from July 1–Sept. 1, 1977, following the fire. During the summer of 1978 a 12 volt battery-operated light was available and was used to sample night flying insects in the burned and unburned 50 m^2 plots described above.

RESULTS

Tables 1,2,3,4 and 5 show the relative number of genera collected in each site in the transect areas. As might be expected there were more genera collected in the unburned than the burned areas. For example, Table 1 shows 72 individuals collected from 4 genera in the burned site and 97 individuals belonging to 13 genera in the unburned. (These numbers are indicated in parentheses following the column headings for the table.) The number of individuals did not vary significantly. Generally the most common arthropods found in burned and unburned sites were ants and spiders. The only specimen collected of special interest was one spider, *Robertus* sp. found in a burned area on Escobas Mesa. This is apparently a new record for this genus in New Mexico and may be a new species.

Table 6 shows the result of collections in the burned and unburned 50 m^2 plots near Ponderosa Campground in July 1977 and 1978. In 1977 the burned area was almost devoid of visual arthropod activity. Four genera, consisting primarily of ants, were collected. The only apparent arthropod life was found under fairly large stones and then only in limited numbers. In 1978, 15 genera were collected in the burned plot. The first insect to appear in any abundance was a species of leafhopper found on grass. In the unburned plot 24 genera were collected in 1977 and 44 genera in 1978.

Table 1.—Arthropod genera collected in burned and unburned areas of Frijoles Mesa.

Burned (72/4)[1]	Unburned (97/13)
Hymenoptera	Hymenoptera
Formicidae	Formicidae
Camponotus sp.	*Pheidole* sp.
Formica sp.	*Camponotus* sp.
	Formica sp.
Coleoptera	
Tenebrionidae	Coleoptera
Eleodes sp.	Buprestidae
	Acmaeocora sp.
Orthoptera	Coccinellidae sp.*
Acrididae	*Anatis* sp.
Melanoplus sp.	
	Diptera
	Chloropidae
	Hippelates sp.
	Muscidae
	Fannia sp.
	Orthoptera
	Gryllidae
	Gryllus sp.
	Hemiptera-Heteroptera
	Miridae
	Irbisia sp.
	Psyllidae
	Trioza sp.
	Araneida
	Lycosidae
	Lycosa sp.
	Theridiidae
	Theridion sp.
	Chilopoda
	Arenophilus sp.

[1] *# of individuals/# of genera.*
* *Only identified to family.*

A New Jersey light trap operated at Ponderosa Campground in 1977 before the fire collected several hundred specimens per trap night, primarily Lepidoptera, Coleoptera and Diptera. Following the fire collections were reduced an estimated 75%. Collections never reached pre-fire levels by September 1977. No records were kept of actual numbers, except in the case of mosquitoes. It is interesting to note the average number of mosquitoes per trap night was 4 before the fire and 5 after. It was observed that after the fire there was a dramatic reduction in filth fly populations. The numbers remained very low the remainder of the summer.

Table 2.—Arthropod genera collected in burned and unburned areas of Burnt Mesa.

Burned (78/5)[1]	Unburned (91/14)
Hymenoptera	Hymenoptera
Formicidae	Formicidae
Pheidole sp.	*Myrmica* sp.
Camponotus ap.	*Pheidole* sp.
	Lasius sp.
Araneida	*Camponotus* sp.
Lycosidae	
Pardosa sp.	Hemiptera-Heteroptera
	Cicadellidae
Diplopoda	*Gyponata* sp.
Abacion sp.	Miridae
	Polymerus sp.
Chilopoda	Nabidae
Arenophilus sp.	*Nabis* sp.
	Deptera
	Muscidae
	Musca sp.
	Fannia sp.
	Orthoptera
	Acrididae
	Melanoplus sp.
	Coleoptera
	Scarabaeidae
	Polyphaga sp.
	Araneida
	Lycosidae
	Lycosa sp.
	Gnaphosidae
	Gnaphosa sp.
	Diplopoda
	Abacion sp.

[1] *# of individuals/# of genera.*

Table 3.—Arthropod genera collected in burned and unburned areas of Escobas Mesa.

Burned (51/7)[1]	Unburned (72/13)
Hymenoptera	Hymenoptera
Formicidae	Formicidae
Camponotus sp.	*Formica* sp.
Formica sp.	*Lasius* sp.
	Pheidole sp.
Diptera	
Muscidae	Diptera
Musca sp.	Muscidae
	Fannia sp.
Areneida	
Lycosidae	Coleoptera
Lycosa sp.	Carabidae
Robertus sp.	*Harpalus* sp.
New record from NM,	Curculionidae
may be new species.	*Thricolepis* sp.
Diplopoda	Hemiptera
Abacion sp.	Cicadellidae
	Gyponana sp.
Chilopoda	Miridae
Arenophilus sp.	*Psallus* sp.
	Araneida
	Lycosidae
	Lycosa sp.
	Pardosa sp.
	Gnaphosidae
	Gnaphosa sp.
	Thomisidae
	Xysticus sp.
	Diplopoda
	Abacion sp.

[1] *# of individuals/# of genera.*

In 1978 the volume of specimens collected per trap night was similar to that collected before the fire in 1977. The UV light trap that was operated two nights in July at the burned and unburned plots produced similar catches at each plot, consisting primarily of Lepidoptera in the families Arctiidae, Lasiocampidae, Noctuidae, Sphingidae, Geometridae, Zygaenidae, Pyralidae, Gelechioidea, Notodontidae, and Saturniidae.

SUMMARY AND CONCLUSIONS

Arthropod collections were made in selected sites at Bandelier National Monument, NM, following the intense forest fire that occurred there in 1977. As might be expected there was a reduction in the number of genera in burned as opposed to unburned areas. The number of individual specimens collected did not vary significantly. This may be due to easier visibility for collecting in burned areas. Most of the individual specimens collected in the burned areas were ants and spiders. In severely burned areas, such as the 50 m^2 plot near Ponderosa Campground, virtually all arthropods were eliminated. One year after the fire the number of genera collected increased, but were below the number of genera collected in the unburned area in 1977. The unburned 50 m^2 plot was near burned areas and was undoubtedly subjected to heat and smoke. This may account for the small number of fly genera collected in 1977 (3) as opposed to the larger number collected in 1978 (10). Strong fliers may have an opportunity to leave the area or perhaps most were eliminated by heat and smoke.

Light trap collections in 1977 were reduced by almost 75% following the fire and remained low

Table 4.—Arthropod genera collected in burned and unburned areas of Apache Mesa.

Burned (61/8)[1]	**Unburned**(89/17)
Hymenoptera	Hymenoptera
Formicidae	Formicidae
Lasius sp.	*Myrmica* sp.
Camponotus sp.	*Lasius* sp.
	Camponotus sp.
Coleoptera	*Leptothorax* sp.
Carabidae	
Calosoma sp.	Coleoptera
	Chrysomelidae
Diptera	*Scelolyperus* sp.
Muscidae	Curculionidae
Fannia sp.	*Gymnetron* sp.
Tipulidae	Cerambycidae
Limonia sp.	*Aneflomorpha* sp.
Araneida	Diptera
Gnaphosidae	Sarcophagidae
Drassodes sp.	*Sarcophaga* sp.
Haplodrassus sp.	Muscidae
	Musca sp.
Chilopoda	Tachinidae
Arenophilus sp.	*Nowickia* sp.
	Hemiptera-Heteroptera
	Cicadellidae
	Gyponana sp.
	Gelastocoridae
	Gelastocoris sp.
	Orthoptera
	Gryllidae
	Gryllus sp.
	Acrididae
	Melanoplus sp.
	Araneida
	Clubionidae
	Micaria sp.
	Lycosidae
	Pardosa sp.
	Gnaphosidae
	Gnaphosa sp.

[1] *# of individuals/# of genera.*

Table 5.—Arthropod genera collected in burned and unburned areas of Frijoles Canyon.

BURNED (59/7)[1]	**UNBURNED** (93/19)
Hymenoptera	Hymenoptera
Formicidae	Formicidae
Camponotus sp.	*Formica* sp.
Formica sp.	*Camponotus* sp.
	Crematogaster sp.
Hemiptera-Heteroptera	*Leptothorax* sp.
Cicadellidae	
Cicadula sp.	Hemiptera-Heteroptera
	Lygaeidae
Coleoptera	*Lygaeus* sp.
Scarabaeidae	Cicadellidae
Aphodius sp.	*Cicadula* sp.
	Miridae
	Labops sp.
Araneida	
Lycosidae	
Pardosa sp.	Coleoptera
Thomisidae sp.*	Chrysomelidae
Xysticus sp.	*Scelolyperus* sp.
	Curculionidae
Chilopoda	*Apion* sp.
Arenophilus sp.	
	Diptera
	Muscidae
	Musca sp.
	Tachinidae
	Peleteria sp.
	Lepidoptera
	Geometridae
	Glena sp.
	Araneida
	Lycosidae
	Lycosa sp.
	Pardosa sp.
	Theridiidae
	Theridion sp.
	Agelenidae
	Agelenopsis sp.
	Salticidae
	Pellenes sp.
	Gnaphosidae
	Zelotes sp.
	Gnaphosa sp.

[1] *# of individuals/# of genera.*
* *Only identified to family.*

for the remainder of the summer. However, in 1978 the volume of specimens collected was similar to that collected prior to the fire. It appears that night flying insects reappear in burned areas rather quickly, especially where there are "islands" of unburned areas scattered throughout the burned areas. Ground inhabiting species and weak fliers appear to return more slowly.

In some areas the drastic reduction in arthropod populations might have an adverse effect on populations of some insectivorous birds or other animals, especially those with highly specific diets.

Table 6.—Arthropod genera collected in burned and unburned plots near Ponderosa Campground in 1977 and 1978.

Burned

1977 (4)[1]

- Hymenoptera
  - Formicidae
    - *Formica* sp.
    - *Pheidole* sp.
- Diptera
  - Tachinidae
    - *Peleteria* sp.
- Araneida
  - Lycosidae
    - *Pardosa* sp.

1978 (15)

- Hymenoptera
  - Formicidae
    - *Formica* sp.
    - *Pheidole* sp.
- Hemiptera-Heteroptera
  - *Cicadellidae* sp.
- Diptera
  - Muscidae
    - *Fannia* sp.
  - Tachinidae
    - *Peleteria* sp.
    - *Sitophaga* sp.
  - Sarcophagidae
    - *Ravinia* sp.
    - *Sarcophaga* sp.
  - Syrphidae
    - *Blera* sp.
- Coleoptera
  - Coccinellidae
    - *Anatis* sp.
      - Buprestidae sp.*
- Orthoptera
  - Acrididae
    - *Melanoplus* sp.
    - *Dissoteria* sp.
- Araneida
  - Lycosidae
    - *Pardosa* sp.
  - Gnaphosidae
    - *Gnaphosa* sp.

Unburned

1977 (24)[1]

- Hymenoptera
  - Formicidae
    - *Pheidole* sp.
    - *Lasius* sp.
    - *Formica* sp.
    - *Camponotus* sp.
- Hemiptera-Heteroptera
  - Cicadellidae
    - *Gyponana* sp.
    - *Exitianus* sp.
  - Aphididae
    - *Cinara* sp.
  - Miridae
    - *Phytocoris* sp.
  - Nabidae
    - *Nabis* sp.
- Coleoptera
  - Scarabaeidae
    - *Cheiroplatys* sp.
  - Lycidae
    - *Dietyopterus* sp.

1978 (44)

- Hymenoptera
  - Formicidae
    - *Conomyrma* sp.
    - *Pheidole* sp.
    - *Liometopum* sp.
    - *Lasius* sp.
    - *Formica* sp.
    - *Camponotus* sp.
- Hemiptera-Heteroptera
  - Cicadellidae
    - *Gyponana* sp.
    - *Ballana* sp.
  - Aphididae
    - *Dactynotus* sp.
    - *Cinara* sp.
  - Psyllidae
    - *Trioza* sp.
  - Miridae
    - *Psallus* sp.
    - *Digiognathus* sp.

Unburned (continued)

1977 (24)[1]

- Elateridae
  - *Melanotus* sp.
- Buprestidae
  - *Acmaeodera* sp.
- Ptinidae
  - *Ptinus* sp.
- Diptera
  - Calliphoridae
    - *Phormia* sp.
  - Bombyliidae
    - *Poecilanthrax* sp.
  - Muscidae
    - *Fannia* sp.
- Hymenoptera
  - Vespidae
    - *Vespula* sp.
- Orthoptera
  - Acrididae
    - *Melanoplus* sp.
    - *Dissosteria* sp.
- Araneida
  - Lycosidae
    - *Lycosa* sp.
    - *Pardosa* sp.
  - Gnaphosidae
    - *Zelotes* sp.
    - *Gnaphosa* sp.

1978 (44)

- Coleoptera
  - Scarabaeidae
    - *Diplotaxis* sp.
    - *Cheiroplatys* sp.
  - Cerambycidae
    - *Cosmosalia* sp.
    - *Anastrangalir* sp.
  - Lycidae
    - *Dietyopterus* sp.
  - Elateridae
    - *Melanotus* sp.
  - Melandryidae
    - *Eustrophinus* sp.
  - Buprestidae
    - *Acmaedera* sp.
  - Chrysomelidae
    - *Pyrrhalta* sp.
  - Ptinidae
    - *Ptinus* sp.
- Diptera
  - Calliphoridae
    - *Phormia* sp.
  - Culicidae
    - *Aedes* sp.
  - Bombyliidae
    - *Poecilanthrax* sp.
  - Sarcophagidae
    - *Ravinia* sp.
    - *Sarcophaga* sp.
  - Mycetophilidae
    - *Mycetophila* sp.
  - Tachinidae
    - *Peleteria* sp.
  - Muscidae
    - *Fannia* sp.
  - Phoridae
    - *Phora* sp.
  - Tipulidae
    - *Tipula* sp.
- Hymenoptera
  - Megachilidae
    - *Megachile* sp.
  - Vespidae
    - *Polistes* sp.
  - Sphecidae
    - *Sphex* sp.
  - Apidae
    - *Bombus* sp.
  - Ichneumonidae
    - *Gelis* sp.
  - Neuroptera
    - *Raphidia* sp.
- Orthoptera
  - Acrididae
    - *Melanoplus* sp.
    - *Dissosteria* sp.
- Araneida
  - Lycosidae
    - *Lycosa* sp.
    - *Pardosa* sp.
  - Gnaphosidae
    - *Gnaphosa* sp.

[1] *# of genera.*

* *Only identified to family.*