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An Assessment of the Conservation Status of the
Western Hognose Snake and other Snakes of the Sand Prairies of
Big River State Forest, Henderson County, Illinois

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Very limited herpetological work has been done in Henderson County, Illinois. Limited and now largely dated work by P.W. Smith in the 1940's, 1950's, and 1960's contributed the most to our current body of knowledge about the herpetofauna there. Because of this and the general conservation problems faced by many vertebrate species in general, we undertook a study of the conservation status of the western hognose snake, *Heterodon nasicus*, a species listed as threatened in the state by the Illinois Department of Natural Resources (Herkert, 1992) in Big River State Forest (Figure 1), a 3000+ acre area owned by the state of Illinois. Our studies began in September and October, 1995, and continued in May, June, July, and August of 1996; we presently continue these studies. We selected these times and focused particularly on June and July because previous scientific research (Platt, 1969; Christiansen, unpublished manuscript) indicated that these were seasonally high activity periods of this species. Our methodology allowed us to assess the abundance of other sand prairie snake species as well.

Since the western hognose snake is a stenotopic species associated with open sand prairie communities (Smith, 1961; Ernst and Barbour, 1989), our primary study area was a 20 acre sand prairie (hereafter termed "southern sand prairie" in this report) located just north of the southern border of Big River State Forest (sections 20D, 20F in Figure 2; Figure 3). Preliminary observations indicated that this sand prairie presently represents the largest expanse of habitat suitable to this threatened species and other xeric biota in the entire 3000 acre state forest. Historically, sand prairie communities were much more extensive in the forest.

Results and Discussion

We used both visual surveys and funnel and box traps associated with drift fences to assess the abundance of the western hognose snake in the southern sand prairie. We utilized eight traps spread among three drift fences in the northern, central, and southern portions of the prairie. During the periods of study, we carried on approximately 285 man-hours of visual searches and 4000 trapping hours (Table 1) with currently acceptable scientific methods for assessing the abundance of snake populations (Vogt and Hine, 1982; Karn, 1986).

General Snake Abundance- It became apparent early in the study (September-October, 1995 and May, 1996) that two snake species, the bull snake (*Pituophis melanoleucus*) and blue racer (*Coluber constrictor*), associated with the sand prairie communities of the western hognose snake were much more abundant than the latter. Hatchlings of each were observed in the fall period, and snakes spanning juvenile to adult size ranges were seen or trapped frequently in May and June, 1996. We do not present quantitative data on these two species here, but only conclude that their present conservation status in Big River State Forest appears to be of no special immediate concern. These two species are eurytopic and not as specialized in their habitat requirements as the western hognose snake (Smith, 1961; Ernst and Barbour, 1989; Conant and Collins, 1991).

One other snake species expected to be in the area, the eastern hognose snake (*Heterodon platirhinos*), was not observed in the sand prairies or other communities of Big River State Forest. A DOR adult specimen was found near Delabar State Park, south of the state forest in May, 1996. This was somewhat surprising as the well-drained sandy soil and abundance of anurans, its chief food item, in the area should support its abundance. Its conservation status in the area should be investigated in future studies.

Western Hognose Snake Abundance- Despite the sampling intensity, only four specimens of the western hognose snake were observed (Table 2). All of these were found at the base of or near (1 m or less) of shrubs or small trees and were small individuals. The three females were likely reproductively immature as Platt (1969) found sexual maturity to occur in female western hognose snakes in Kansas at approximately 350 mm SVL. The density appears to be very low in the southern sand prairie of Big River State Forest, as Platt (1969) estimated densities of 1.5-2.5 snakes per acre in viable populations in several Kansas prairies. Qualitative comparisons with Big Sand Mound Prairie in Louisa County, Iowa, where there is a viable population of western hognose snakes and which we visited several times for baseline data, indicates that this species is much less abundant in the southern sand prairie of Big River State Forest. At Big Sand Mound Prairie, this species is often seen on most excursions in May and June as indicated by our observations and those by J. Christiansen of Drake University (Christiansen, unpublished manuscript).

To date in 1997, only one large female specimen was observed in the southern sand prairie, despite intense sampling methods similar to those employed in 1996.

Local residents and visitors to the southern sand prairie familiar with western hognose snake invariably have stated that they have seen many more ten years ago than within the past several years. Several have used the word "extinct" in inquiries to us.

We conclude that the population size of the western hognose snake in Big River State Forest is precipitously low, suggesting a serious negative conservation status. Problems involving quantity and quality of habitat, implicated often in other studies on animals populations near extinction (Caughley and Gunn, 1996; Meffe et al., 1997), in Big River State Forest appear to be major reasons for this; these two considerations are examined below.

Habitat Size - The 20 acre southern sand prairie is of the best quality and is the largest available sand prairie habitat in Big River State Forest but represents only .66% (less than 1 %) of the land in the 3000 acre forest. Other small sand prairie tracts exist which are spatially discontinuous with the southern sand prairie. Approximately 20 hours of visual surveys in these other tracts did not reveal western hognose snakes; however, these have conservation potential (see below).

We wish to point out that in addition to the western hognose snake, other endangered biota occur in the sand prairie (see Herkert, 1991, 1992). So in Big River State Forest which represents the largest tract of Illinois public land in this area of Illinois, far less than one percent is suitable habitat for endangered and threatened species associated with sand

prairies, with the rest apparently prioritized for other interests. Extinction probabilities of small populations are inversely related to habitat size (Meffe et al., 1997), and the size of the southern sand prairie is likely not large enough to sustain the population of western hognose snakes for any length of time.

Sand prairie communities have existed in this area of Illinois for thousands of years and many more existed in the past, even as recently as 20 years ago than do presently, as indicated by records from collected specimens and interviews with locals. There have been reductions of sand prairie communities in Big River State Forest over the past thirty years which were initialized by the removal of the railroad tracks from the area; burning around the railroad right-of-ways apparently maintained the sand prairies (pers. comm., State Forest personnel and local inhabitants of adjacent areas).

Habitat Quality & Abuse- The quality of the remaining sand prairie communities in the southern sand prairie of Big River State Forest is poor, and is generally unprotected and subject to various forms of human abuse.

Many formerly open areas are being closed by weedy and tall grass species, particularly in the western and southern portions of this prairie. Controlled and careful spot burning is needed, but see below ("Hognose snakes and Thermoregulation"). Ironically, a recent burn by the IDNR in April, 1997, focused on the best quality, northern area of this sand prairie and did nothing to ameliorate the deterioration in the southern and western portions.

With respect to abuse by humans, we have observed the following in 1995, 1996, and in the current year to date:

- (1) evidence of vehicles riding through the sand prairie, with tire tracks running over endangered plant species. These vehicles include large, conventional ones as well as ATV and other off-road types. (numerous photos available; contact ALM)
- (2) evidence of extensive horseback riding through the sand prairie, especially on a diagonal northeast/southwest old lane, but also off this lane as well. These areas are near those at which most of the hognose snakes we have observed were found. (photos available; contact ALM).
- (3) hunters stating to one of us (ALM) in fall, '95, on two separate occasions and involving separate individuals, that they shoot snakes. Another individual who lives near the sand prairie stated he once killed one with stick; he apparently saw the snake in the sand on the edge of the prairie (he called it a "sand viper"; behavioral characteristics of the Western Hognose Snake make identification by lay people much easier than with most other snake species.)
- (4) extensive debris from skeet shooting activities and numerous spent shotgun shells in the prairie. (photos available; contact ALM)
- (5) beer bottles and other garbage in the sand prairie. (photos available; contact ALM)

One readily gets the impression that this small sand prairie, technically part of a large area designated a "natural area" by the IDNR, is an unprotected, uncared-for playground for public recreation rather than a sanctuary for the last bit of remaining sand prairie flora and

fauna in the county. This situation is particularly ironic when one considers the large size of Big River State Forest which is favorable to peaceful coexistence between recreational interests and the preservation and conservation of the native biodiversity. Most public areas do not have this luxury because they are smaller.

Extinction - Stochastic processes coupled with biological ones hasten extinction in such small populations in restricted habitat areas (Gilpin and Soule, 1986; Caughley and Gunn, 1996; Meffe et al., 1997). These are referred to by conservation biologists as "extinction vortices" and basically result from stochastic processes related to demographic processes and the lack of genetic variability and subsequent fitness in small populations with limited genetic resources.

Our conclusion from our research on abundance and habitat viability is that this species is in critical endangerment in Big River State Forest. A preliminary Population Viability Analysis (Lacey, 1993) indicates a high probability that the western hognose snake will be extinct there within 5 years if preservation measures are not implemented quickly with long term conservation measures following. We wish to emphasize that saving a population on the verge of extinction is always easier than trying to repopulate an area after extinction has occurred (Dodd and Seigel, 1991; Meffe et al., 1997). Also, extinction of this population would likely represent extinction of the relictual population in Henderson County, Illinois, as Big River State Forest is suspected to have the last remaining viable population; previous human disturbances have obviously resulted in the elimination of much suitable habitat and associated fauna and flora in the county as indicated by the records of this species in the county from Smith's work in the 1940's, 1950's and 1960's.

Western Hognose Snakes, Microhabitats, and Prairie Restoration. While the typical habitat of the western hognose snake is often cited in general works such as field guides (e.g. Conant and Collins, 1991) as "sand prairie", specific microhabitat details important for the preservation and conservation of this species are often lacking. Numerous observations over many years by J. Christiansen of Drake University on western Hognose snakes at Big Sand Mound Prairie in Iowa, those by Platt (1969), and our own indicate that this species is often found in the vicinity of taller vegetation such as shrubs and bushes in open areas, such as the fragrant sumac, *Rhus aromatica*, a common shrub both in Big Sand Mound and in the southern sand prairie. All the specimens we observed were near such sumac bushes or blackjack oaks, *Quercus marilandica*, also common in this prairie. Thus, a dunesland landscape with structurally homogeneous short vegetation appears inappropriate for this species but rather open sand prairie punctuated with sparse taller vegetation seems to be preferred.

While a detailed ecological study on microhabitat and predation is unavailable, J. Christiansen and we speculate that the taller vegetation provides two important resources for this species: thermoregulation and concealment. J. Christiansen has noted increased raptor presence in open areas after burns, and suggests that the predation rate on sand prairie species may be high. This is a relatively important consideration with respect to prairie burns and the preservation and conservation of this species (see below).

Recommendations: Preservation and Conservation. Conservation biologists generally agree that rescuing a species in such a poor conservation status as the western hognose snake is in Henderson County involves a two step process involving acute preservation and protection measures of the population followed by long-term conservation measures which involve habitat enhancement and expansion (Caughley and Gunn, 1996; Meffe et al., 1997).

Acute, Immediate Measures. To preserve the remaining restricted gene pool of this species and to restore the general ecological health of the sand prairie ecosystem, we recommend the following *immediate* preservation measures for the 20 acre southern sand prairie and surrounding area:

- 1.) Clear signage which prohibits horseback riding on this prairie. There is no such signage at present, and we, after spending so much time in the area, are still unclear as to where horseback riding is allowed with respect to the prairie and surrounding fire lanes. It is unreasonable to expect a few people on a day's outing to read an hour's worth of regulations at the forest headquarters where they are posted.
- 2.) Elimination of hunting, skeet shooting, etc. on the prairie. While a skeet shooting area exists near the forest headquarters, there is a sign for "Hunter's Parking" in the parking lot of the sand prairie (next to a sign which says "Natural Area..."). Clearly, hunters may reasonably assume that skeet shooting is allowed here if hunting is. Prohibiting only skeet

shooting will not eliminate the hunters who actively kill snakes. Again, we emphasize that hunters have the remaining area of the forest, approximately 3000 acres, for their activities.

3.) A fence around the sand prairie to eliminate off-road vehicles and other unnatural and potentially catastrophic disturbances. One vehicle going through this area at the wrong time may reduce the snake and endangered plant populations by a significant amount.

4.) Increased vigilance around the area. In all our hours on this site, no one in any official capacity ever inquired about our activities. Official presence is critically important to thwart human abuse.

5.) Controlled burning of the western and southern edges of the prairie. In these areas, weeds are eliminating and/or reducing open areas, and it is essential that this situation be rectified as soon as possible. We strongly suggest spot burning in this fragile area, and the retention of fragrant sumac bushes as well as a few scattered, and preferably young blackjack oak clumps (see section above, "Western Hognose Snakes, Microhabitat, and Prairie Restoration").

6.) Continued monitoring of the viability of the population and habitat.

Long-term Conservation Measures. The main requirement for successful long-term conservation of the sand prairie ecosystems and their associated biota in Big River State Forest involves restoration of more sand prairie areas, particularly in areas in the southern portion of the forest. The southern sand prairie can easily serve as a "source" for populations to repopulate adjacent sand prairies if restoration is done intelligently and with migration corridors in mind. Source populations have been drawn upon in other conservation efforts involving various animal species (Caughley and Gunn, 1996; Meffe et al., 1997).

Restoring prairie adjacent to the southern sand prairie should be viewed as a viable long-term conservation goal and we recommend that a minimum size should be 100-120 acres of continuous sand prairie in this area.

An area to the northwest of the southern sand prairie almost serves as a prepatterned blueprint for immediate and easy restoration. This area resulted from the former railroad right-of-way mentioned above in this report and consists of two wide fire lanes running roughly parallel, with the western one curving to the west for a distance and then back east (Fig. 3). In between these two fire lanes several open areas contain healthy sand prairie and can easily serve as a nucleus for restoration.

It is recommended that one of these fire lanes (two are obviously not necessary for fire control), either the eastern or western one pending evaluation, be discontinued as a fire lane and left undisturbed and that the adjacent vegetational island be burned. This measure will restore a significant amount of sand prairie which will be continuous with the southern

sand prairie and can serve as a potential migration corridor to other restored sand prairies to the north in the forest in the future.

Several small sand prairies, resulting from fairly recent logging operations, exist in the southern portion of Big River State Forest (e.g., section 17H in Fig. 2). These should be maintained and hopefully can be connected to an expanding sand prairie, with the southern sand prairie as a source nucleus, by various other corridors.

Summary

- 1.) The conservation status of the threatened western hognose snake in Big River State Forest, Henderson County, Illinois is negative and is likely related to deficiencies in the quantity and quality of appropriate sand prairie habitat.
- 2.) This species and likely other stenotopic sand prairie biotic elements will probably become extinct there if acute preservation measures are not quickly implemented followed by long-term conservation measures involving restoration of more sand prairie communities.
- 3.) Specific recommendations related to acute preservation and long-term conservation of the sand prairie biota in Big River State Forest are made.

TABLE 1

Survey man-hours and trap-hours in 20 acre southern sand prairie in Big River State Forest, Keithsburg, Illinois, in various months in 1995 and 1996.

Month	Survey Man-hours ^a	Trap-hours ^b
Sept., Oct. 1995	14	0
May, 1996	16.5	0
June, 1996	154.75	1,992
July, 1996	75.5	1,884
Aug., Sept., 1996	23.0	80
TOTAL	269.75	3,956

^a survey man-hours = sum of (number of hours spent in visual surveying by each individual).

^b trap-hours = number of traps x hours in which they were activated.

TABLE 2

Collection and other data of four Western Hognose snakes observed in southern sand prairie, Big River State Forest, in 1996.

Specimen #	Sex	SVL ^a	Tail L ^b	Date	Time	Marked ^c	Trap or Visual
1	F	300	35	6/21/96	0955	V-1, L	Visual
2	M	300	75	6/27/96	1915	V-2, L	Trap
3	F	195	27.5	6/24/96	2000	No	Visual
4	F	330	50	7/7/96	0845	V-3, L	Visual

^a snout-vent length in millimeters.

^b tail length in millimeters.

^c Number following "V" indicates number of ventral scale anterior to anal plate. The left half of this scale was clipped off following the methods of Brown and Parker (1976).

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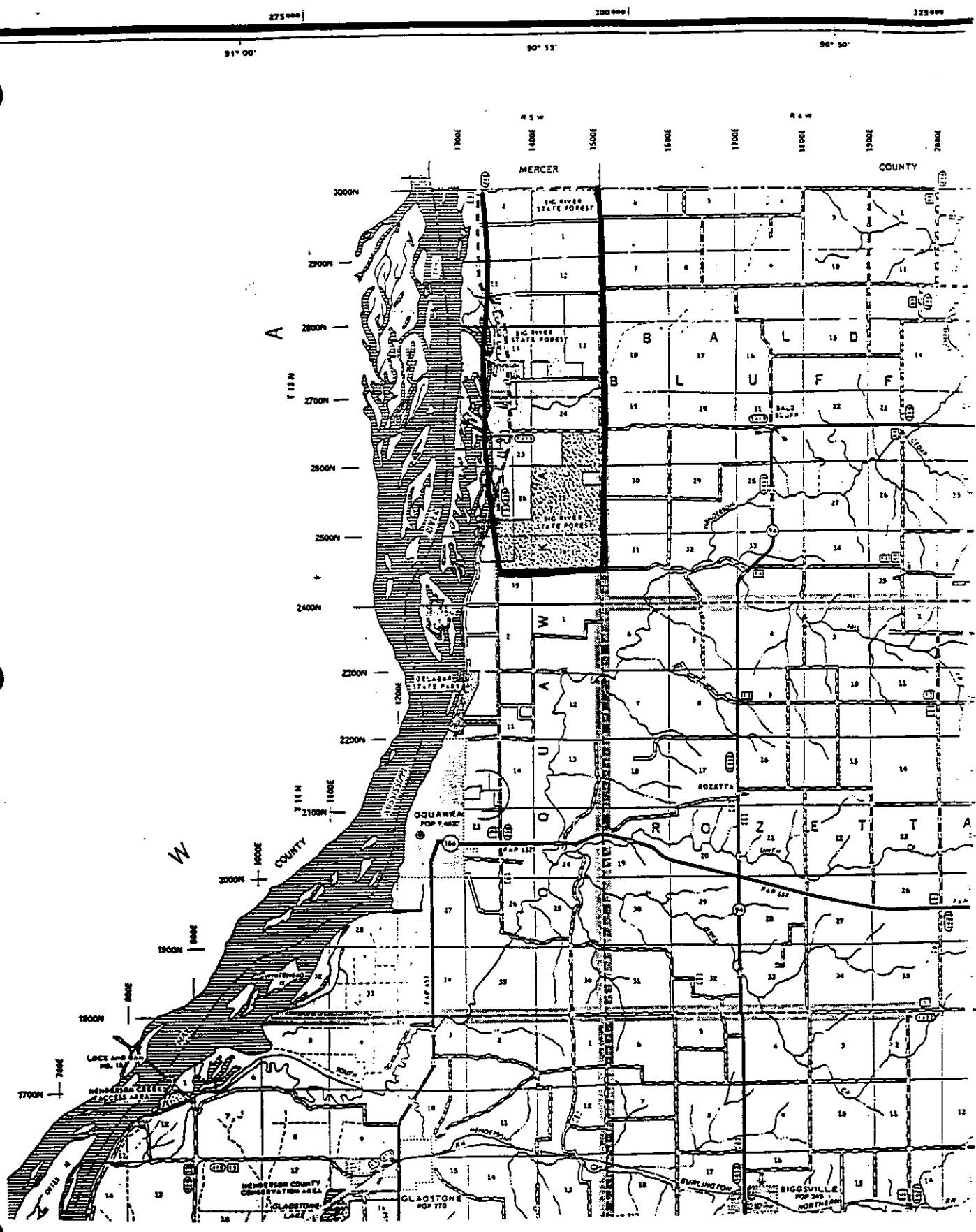


Figure 1. Section of Henderson County highway map showing location of Big River State Forest.

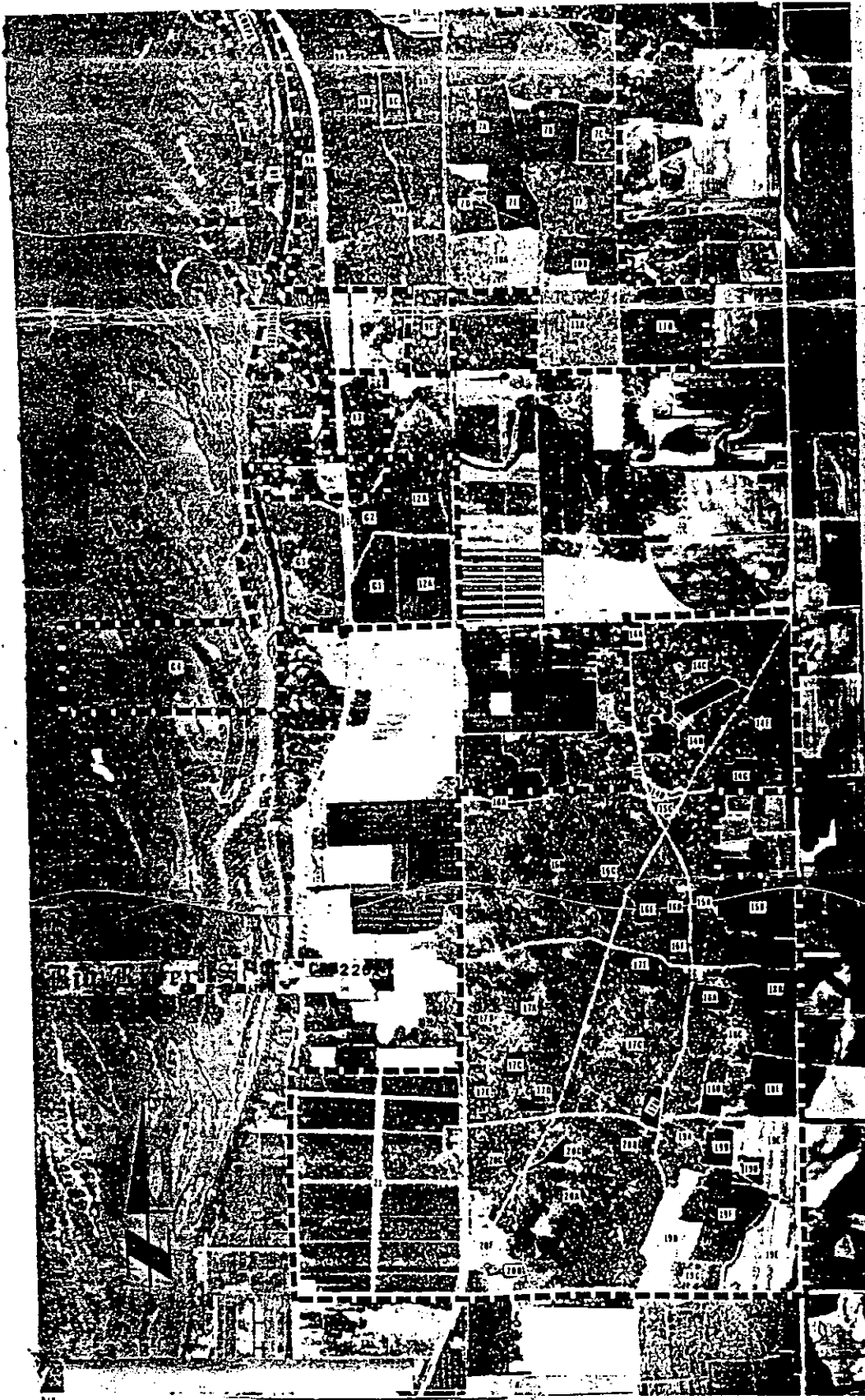
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Figure. 2. Aerial view of the southern portion Big River State Forest. Southern sand prairie is in sections 20D and 20F along southern boundary. Dashed lines indicate State Forest boundaries.



Figure 3. Aerial photo of southern sand prairie in Big River State Forest and adjacent features. A potential restoration site is shown and indicated by "R"s on this figure. It consists of two parallel fire lanes which begin around the northwest corner of the sand prairie. In between the fire lanes there is a nucleus of native sand prairie vegetation. Forest boundaries are indicated by bold dashed lines. See text for further details.