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AERIAL PHOTOGRAPHIC DETERMINATION OF ANIMAL MOVEMENT SURFACE AREA IN STEEP TERRAIN[1]

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An increase in individual animal movement studies through improved marking technique has resulted in a greater need for measuring specific ground surface areas over which these animals travel. The method described here is intended to provide the field worker with a means for measuring small ground tract surface areas in mountainous country. The technique is acceptably accurate,[3] less costly than conventional ground methods, requires little photogrammetric training, and utilizes only simple equipment (stereoscope, ruler, dot grid). The basic principle is an old but tested one - the patent for the radial line plot technique, upon which this method is based, having been issued in 1893!

The need for this technique developed while one of the authors (Martinka) was conducting an intensive study of male blue grouse (Dendragopus obscurus pallidus) breeding territories in the Sapphire Mountains of western Montana. Application of the method proved to be much faster and simpler than making actual ground measurements -- e.g., surface areas requiring 4-5 days to measure on the ground were accomplished in 3-4 hours on the photos with no significant loss in accuracy.

STEP 1: Preliminary Photo Preparation (Figure 1)

a. Pick principal points (PP) and conjugate principal points (CPP) on all photo stereoscopic pairs upon which tracts will appear.
b. Rule in the flight lines and extensions.

STEP 2: Field Procedure (Figure 2)

a. Locate corners of tracts on ground, pinprick on photo whose center lies closest to the tract and transfer these points to adjoining photo.

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[3] When used on photographs having less than 3° of tilt.

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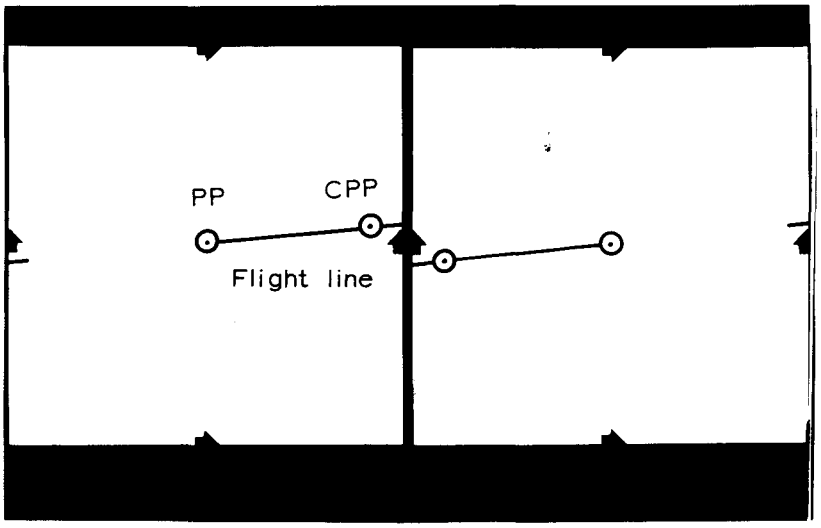
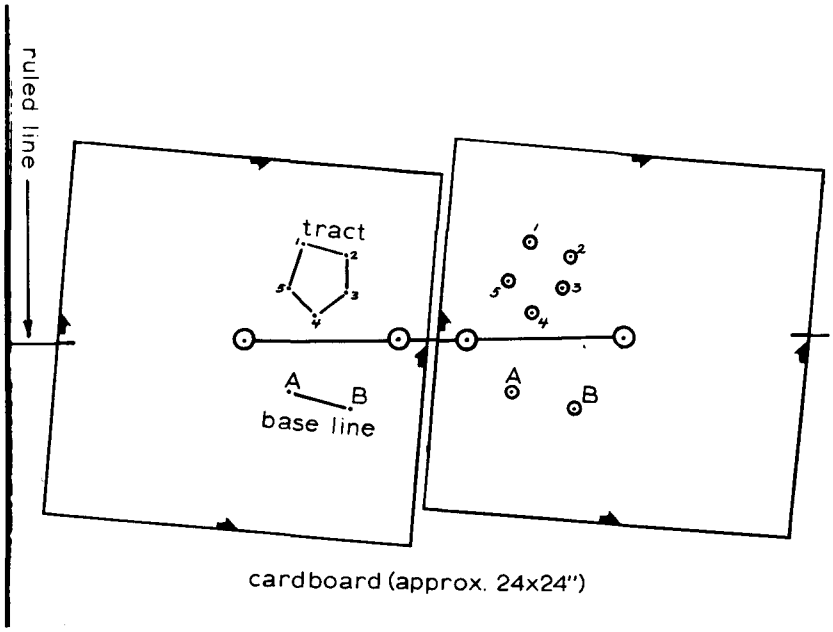


Figure 1. Diagram of stereo pair of photos prepared for use.

Figure 2. Diagram of a stereo pair of photos with tract corners and base line terminals pinpricked, transferred and labelled; photo pair in position for transfer of points to the radial line plot.



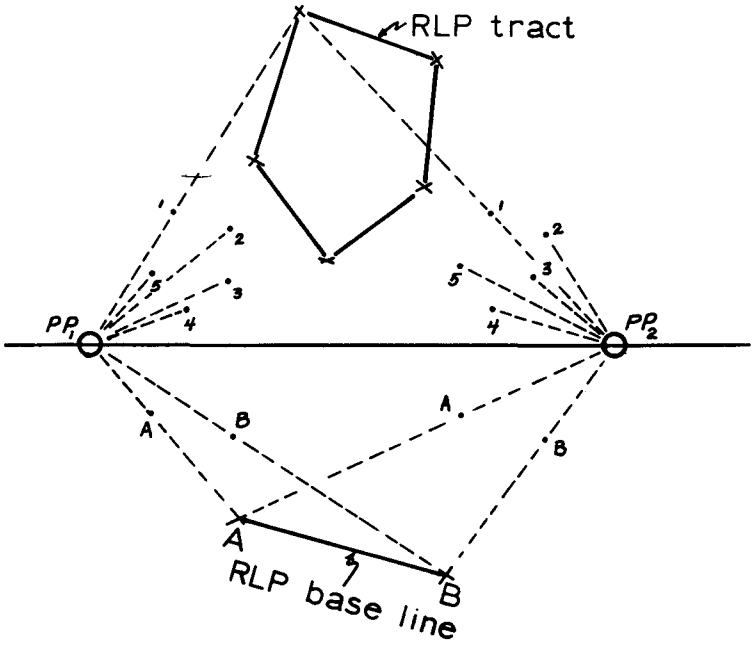


Figure 3. Diagram of a completed radial line plot. Some of the radial lines necessary to obtain the intersections have been omitted in order to make the illustration easier to interpret.

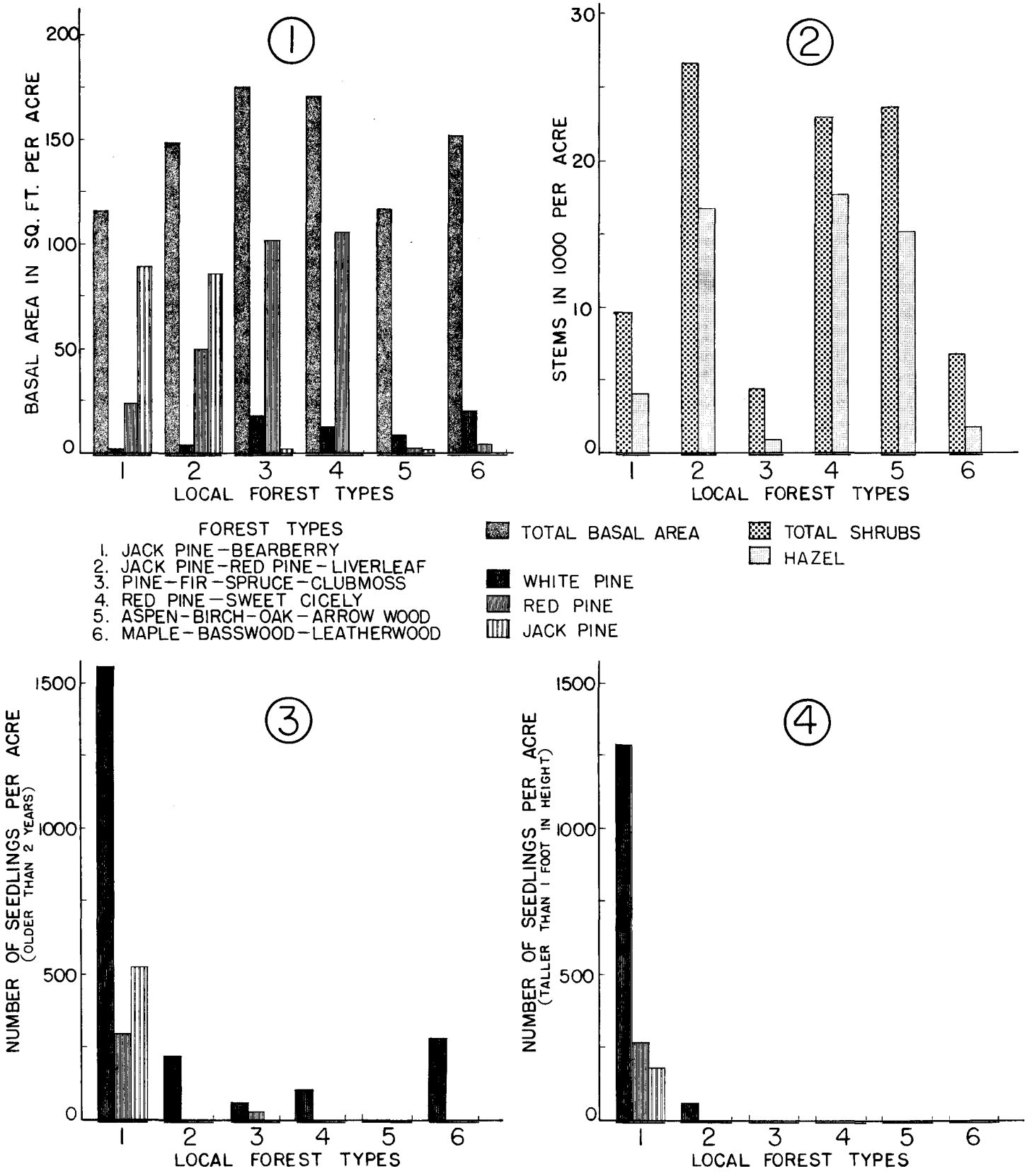


Figure 2. (1) Stand basal area, (2) number of shrubs, and number of pine seedlings, (3) older than two years, and, (4) taller than one foot in height by local forest types in Itasca State Park, Minnesota.

The number of white pine seedlings taller than one foot (Figure 2-4) indicates a satisfactory height growth only in the jack pine-bearberry type. White pine seedlings in the maple-basswood-leatherwood type with dense tree cover and strong competition of hardwood reproduction, although relatively numerous, have not reached a foot of height even at the age of 15 years. The lack of white pine and other pine seedlings in height classes over one foot in most of the forest types, except jack pine-bearberry type, is striking. This indicates that although there is some initial seedling establishment, further development is a critical problem, particularly with white pine. Red and jack pine seedlings do not establish even initially except for a scattered occurrence in the jack pine-bearberry type. In general, white pine is an invading species becoming initially established over a wide range of site and stand conditions. However, it does not survive under strong shrub or tolerant hardwood competition. Total shrub density and the pr-portion of beaked hazel (Corylus cornuta Marsch.) is shown by forest types in Figure 2-2.

Red Pine and Jack Pine Reproduction. The distribution pattern of red pine and jack pine seedlings in the edaphic field differs considerably from that of white pine seedlings (Figure 1). The distribution range of these seedlings is narrower than that of mature red pine and jack pine trees. Scattered red pine and jack pine seedlings in all age groups are largely confined to dry, nutrient-poor sites, mainly in the jack pine-bearberry type. Even in this type ground cover species, mainly halfshrubs, grasses, and invading shrubs appear to be serious competitors of pine seedlings for soil moisture. Furthermore, forest communities of the jack pine-bearberry type constitute only a small fraction of the total area of upland forests in the park. Without some disturbance such as fire even this forest type is unsuitable for new pine establishment. The complete lack of one to two-year old red and white pine seedlings on dry, nutrient-poor sites (Figure 1) is probably a result of an inadequate seed supply and severe drought in July, 1965 preceding data collection. The total number of red pine and jack pine seedlings per acre has some significance only in the jack pine-bearberry type. There are about 300 red pine seedlings per acre in this type (Figure 2-3). Jack pine seedlings are more abundant than red pine; however, jack pine seedlings were heavily browsed and their survival questionable.

Red and jack pine seedlings can be found on roadsides, old gravel pits, and in openings along trails. However, the area occupied is minute compared to the acreage of mature red pine and jack pine stands.

Perpetuation of Present Pine Stands. It seems clear that without major disturbances or special silvicultural measure the present area of pine dominated stands will continue to decline. While white pine seedlings establish initially, they do not survive the competition of dense shrub canopies or tolerant hardwood trees. By contrast, red and jack pine seedlings do not even establish initially under present stand and site conditions.

Literature Cited

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Kurmis, V. and H. L. Hansen. 1969. Reproduction characteristics of upland forest communities in Itasca State Park, Minnesota. Minn. For. Res. Notes No. 209. 4 pp.

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