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Wind-erosion Direction Factors as Influenced by Field Shape and Wind Preponderance

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ABSTRACT

This investigation expands and improves the procedure for determining median travel distance of wind in traversing a field, information used in solving the wind-erosion equation. Wind-erosion roses were simulated by the equation of an ellipse in polar coordinates. The ratio of semimajor axis to semiminor axis was varied to give preponderance values from 1.0 to 4.0. The axis was rotated to simulate field orientation from 0 to 90° relative to prevailing wind-erosion direction. Length/width ratio for rectangular fields was varied from 1 to 10. The wind-erosion direction factor, a number that when multiplied by field width gives median travel distance, was calculated for many combinations of variables. When preponderance was 1.0, the wind-erosion direction factor was 1.03, 1.42, 1.48, and 1.48 for rectangular fields with length/width ratios of 1, 2, 4, and 10, respectively; the factor was not influenced by field orientation. As preponderance increased, the wind-erosion direction factor approached unity for small angles of deviation and approached the length/width ratio for large angles of deviation. For circular fields surrounded by a nonerodible surface, the wind-erosion direction factor was 0.91, regardless of wind direction and preponderance.

Additional Index Words: **prevailing-direction, preponderance, deviation, field-orientation, field-shape.**

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WOODRUFF AND SIDDOWAY (1965) in presenting their a "Wind erosion equation" defined an equivalent field length, L^1, as the unsheltered distance across the field along the prevailing wind-erosion direction. That definition was based on wind traveling a distance of L^1 in traversing the field. Skidmore and Woodruff (1968) reasoned that unless all the wind-erosion forces occurred along the prevailing wind-erosion direction, some of the wind would travel distances $>L^1$ in traversing the field; and at angles of deviation >0, some wind would travel less than L^1 in traversing a field strip. They proposed that it would be more meaningful to base equivalent field width on the preponderance of wind-erosion forces in the prevailing wind-erosion direction as well as deviation of right angles of the strip from the prevailing direction.

Using empirical data, Skidmore and Woodruff (1968) calculated the percentage of wind-erosion forces traveling distances equal to or greater than factor k (multiples of field width) times field width in traversing a field strip for various preponderances and deviations.

In developing a computer solution of the wind-erosion equation, Skidmore et al. (1970, Fig. 3) made a composite of the earlier figures to give k_{50} or median travel distance. That development involved a small sample of empirical data and a crude interpolation; only one field shape, an infinitely long strip, was considered. The purpose here is to expand and improve an earlier procedure for determining median travel distance (equivalent field length) by considering an additional field shape, length-to-width ratios, and replacing the limited empirical data with theoretical calculations.

ANALYSIS

Determination of Midarea Chord

Rectangular Fields

A rectangular field is an area in two dimensions: length (the longer) and width (the shorter). In traversing the field along a line perpendicular to the field length, wind travels a distance equal to the field width. However, if the wind were to traverse the field at some other incident angle, it would travel another distance. When uninfluenced by corners, that distance would equal field width/cos θ, where θ is the angle of incident wind relative to perpendicular to the direction of field length. When wind traverses the field corners parallel to the wind direction, it travels shorter distances as it sweeps toward the apex of the corner triangle.

A midarea chord (MAC) approximates how wide the overall field appears to the wind traversing it and is the length across a rectangular field at angle θ, for which half of the total field area is represented by parallel chords equal to or greater than the midarea chord. The other half of the field is represented by chords shorter than the midarea chord.

Figure 1 illustrates a field of width x and length nx, where n is the length-to-width ratio; θ is angle of incident wind relative to perpendicular to direction of field length; r^1 is chord length; and x^1 and y^1 are base and height, respectively, of a right triangle, $x^1 = r^1 \cos\theta$, $y^1 = r^1 \sin\theta$.

Three separate conditions exist and each requires a different procedure for determining midarea chord. Condition 1, where $x^1 = x$, exists when the area in the corners represented in Fig. 1A. is equal to or less than the area between the corners. It can be seen that the area in the corners equals the area between them when

$$x^1y^1 = dr^1 . \quad [1]$$

By substituting trigonometric functions into Eq. [1] and simplifying, Eq. [1] becomes

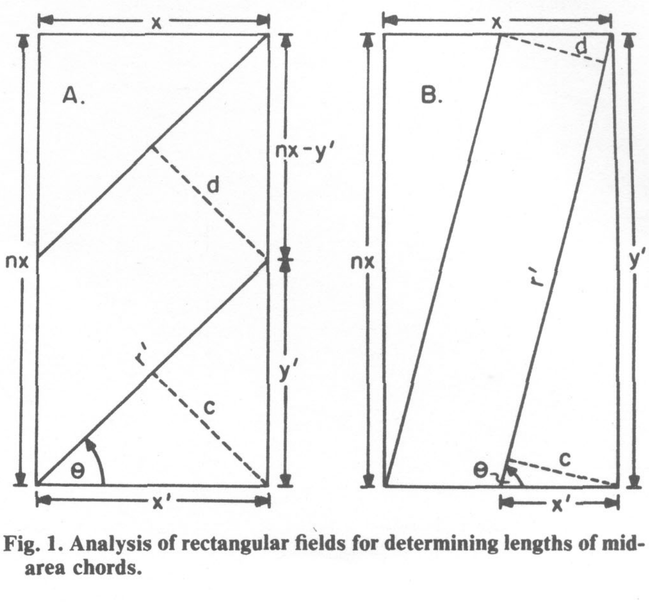

Fig. 1. Analysis of rectangular fields for determining lengths of midarea chords.

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$$\sin \theta^1 = n \cos \theta^1 - \sin \theta^1 \quad [2]$$

where θ^1 is the value of θ that satisfies Eq. [2]. Condition 1 exists when $0 \leq \theta \leq \theta^2$. For this situation,

$$\text{MAC} = x/\cos \theta . \quad [3]$$

Condition 2 exists as y^1 increases to the limit of nx and x^1 decreases to $0.5x$. Therefore,

$$\theta^{11} = \arctan (nx/0.5x) = \arctan (2n) \quad [4]$$

where θ^{11} is the value of θ separating condition 2 from condition 1. While condition 2 exists, the areas in the corners equal one-half the total area. In other words,

$$x^1 y^1 = nx^2/2 . \quad [5]$$

By substituting trigonometric functions into Eq. [5] and solving for chord length, one obtains

$$\text{MAC} = x\,[n/(2 \cos \theta \sin \theta)]^{1/2} . \quad [6]$$

Condition 3 exists for $\theta^{11} < \theta \leq 90$ and for this condition

$$\text{MAC} = nx/\sin \theta . \quad [7]$$

The values of θ^1 and θ^{11} depend on the length/width ratio, n. For $n = 2$, Fig. 1A. and 1B. show the limit between conditions 1 to 2 and 2 to 3, respectively. Figure 2 shows the value of θ^1 and θ^{11} for values of n up to 10. For a square field, or when $n = 1$, the field appears to be the widest when wind direction is at 27 or 63°. As the angle of incident wind increases from 0 to 90° for large length/width ratios ($n = 10$), the length of MAC increases from a distance equal to field width to 10 times the field width (Fig. 3).

The analysis thus far accounted for wind directions varying from 0 to 90°. Extending the analysis to 360° yields the expressions shown in Table 1.

Circular Fields

For circular fields, the midarea chord is the length of chord subtending an angle α, where twice the area of the segment bounded by the chord and arc of the circle equals one-half the area of the circle of radius, r. That occurs for the value of α, satisfying Eq. [8].

$$2(\pi r^2 \alpha/360 - r^2 \sin \alpha/2) = \pi r^2/2 . \quad [8]$$

Equation [8] is satisfied when $\alpha = 132.35°$. The length of chord subtending angle α is found from Eq. [9],

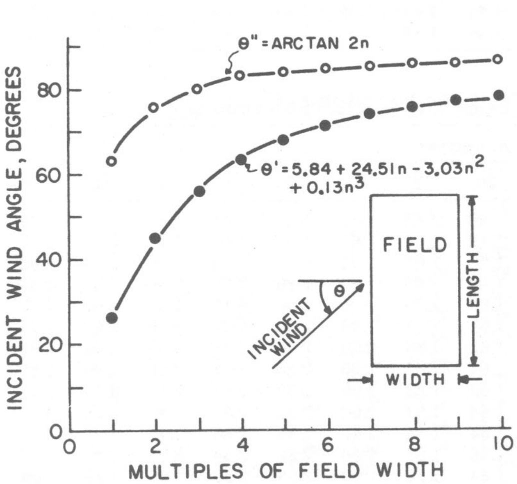

Fig. 2. Delineating the limits where the various equations apply for calculating length of midarea chords for rectangular fields.

Table 1. Expressions for calculating midarea chords for rectangular fields and their range of applications, summarized.

Condition	Expressions for calculating MAC†	Range of θ‡	Example $n = 1$
	x = field width	degrees	
1	$x/\cos \theta$	$0 \leq \theta \leq \theta'$	0–27
1	$x/\|\cos \theta\|$	$180 - \theta' \leq \theta \leq 180$	153–180
1	$x/\|\cos \theta\|$	$180 \leq \theta \leq 180 + \theta'$	180–207
1	$x/\cos \theta$	$360 - \theta' \leq \theta \leq 360$	333–360
2	$x(n/2 \cos \theta \sin \theta)^{1/2}$	$\theta' \leq \theta \leq \theta''$	27–63
2	$x(n/2\ \|\cos \theta \sin \theta\|)^{1/2}$	$180 - \theta'' \leq \theta \leq 180 - \theta'$	117–153
2	$x(n/2\ \|\cos \theta \sin \theta\|)^{1/2}$	$180 + \theta' \leq \theta \leq 180 + \theta''$	207–243
2	$x(n/2 \cos \theta \sin \theta\|)^{1/2}$	$360 - \theta'' \leq \theta \leq 360 - \theta'$	297–333
3	$nx/\sin \theta$	$\theta'' \leq \theta \leq 90$	63–90
3	$nx/\sin \theta$	$90 \leq \theta \leq 180 - \theta''$	90–117
3	$nx/\|\sin \theta\|$	$180 + \theta'' \leq \theta \leq 270$	243–270
3	$nx/\|\sin \theta\|$	$270 \leq \theta \leq 360 - \theta''$	270–297

† x = field width; n = field length to width ratio.
‡ θ' and θ'' are defined in Fig. 2.

$$\text{chord length} = 2r \sin (\alpha/2) . \quad [9]$$

Therefore, the length of the midarea chord for a circular field is

$$\text{MAC} = 1.83r \quad [10]$$

and is independent of wind direction and preponderance.

Simulation of Wind-erosion Roses

Midarea chords approximate the distance across a field as it appears to the wind when the wind comes from a particular direction relative to the field orientation. The wind often changes speed and direction so wind-erosion roses calculated from wind data are often used to represent direction and magnitude of wind-erosion force vectors at a location. I used Eq. [11], an ellipse in polar coordinates, to simulate a series of symmetrical wind-erosion roses,

$$r_j = ab/(a^2 \sin^2 \theta_j + b^2 \cos^2 \theta_j)^{1/2} \quad [11]$$

where a and b are semimajor axis and semiminor axis, respectively. The value of r_j represents magnitude of wind-erosion forces in direction θ_j.

Figure 4 illustrates an ellipse where $a/b = 3.33$. Angle θ_j was varied from 0 to 360° in increments of 5° to give an r_j for each of 72 equally spaced directions (in the illustration

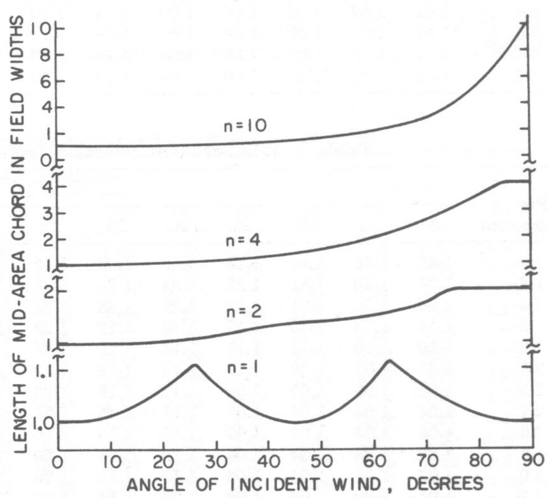

Fig. 3. The equation for θ^1 is a least squares fit of data that satisfies Eq. [2]. Length of midarea chords of rectangular fields as influenced by angle of incident wind and length/width ratio, n.

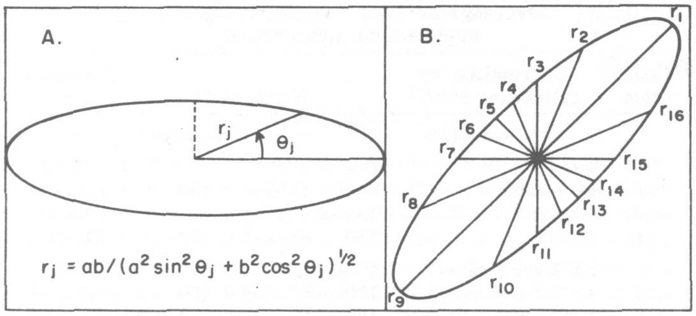

Fig. 4. Wind-erosion rose simulated by an ellipse.

of Fig. 4B., θ_j was varied in increments of 22.5°). The relative value of each r_j was calculated by dividing each r_j by the sum of all r_j.

Preponderance of simulated wind-erosion forces in the direction of the major axis (prevailing wind-erosion direction) was calculated by dividing the results obtained from Eq. [12] by Eq. [13]

$$F_{\parallel} = \Sigma_{j=0}^{71} r_j \mid \cos (5j) \mid \qquad [12]$$

$$F_{\perp} = \Sigma_{j=0}^{71} r_j \mid \sin (5j) \mid \qquad [13]$$

where $F_{\parallel}$ and $F_{\perp}$ are the sum of the resultant wind-erosion forces parallel to and perpendicular to the major axis.

Values obtained for a and b of Eq. [11] defined wind-erosion roses having preponderances from 1.00 to 4.00 in increments of 0.20.

Deviation Angle

The axis of the ellipse was rotated from 0 to 90° in increments of 5° to simulate deviation of the prevailing wind-erosion direction from a right angle to the field length. A rotation of 45° is shown in Fig. 4B. Each r_j retains the same value it had before rotation, but after rotation each r_j is associated with a different midarea chord. For example, before rotation MAC(1) was associated with $\theta = 0$ and was equal to field width; after rotation, MAC(1) was associated with $\theta = 45°$ and could be calculated by the appropriate equation from Table 1.

PROCEDURE

A midarea chord was calculated by the method previously described for each of the 72 vectors of the simulated wind-erosion rose. The relative portion of total wind-erosion forces associated with each vector was evaluated by Eq. [11]. The 72 midarea chords were sorted and arranged by length; all of the same length were combined. The portion of the wind-erosion forces associated with the combined midarea chords was summed for each combination and then accumulated. That gave a frequency distribution of midarea chords. The median travel distance was determined to be the value of the midarea chord corresponding to 50% of the total wind-erosion forces.

The procedure in the above paragraph was repeated for the various combinations of variables: preponderance 1.0 through 4.0 by increments of 0.2; deviation angle 0 through 90 by increments of 5°; field length/width ratio 1, 2, 4, and 10.

Table 2. Wind-erosion direction factor for rectangular fields with length/width ratio of 2.

Pre-	Angle of deviation in degrees																		
ponderance	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
1.0	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
1.2	1.30	1.30	1.31	1.32	1.34	1.36	1.38	1.41	1.42	1.42	1.42	1.43	1.43	1.44	1.45	1.45	1.46	1.46	1.46
1.4	1.20	1.20	1.21	1.23	1.25	1.28	1.32	1.37	1.41	1.42	1.42	1.44	1.45	1.47	1.50	1.51	1.53	1.54	1.55
1.6	1.14	1.14	1.15	1.17	1.20	1.23	1.28	1.34	1.40	1.42	1.43	1.45	1.48	1.51	1.55	1.59	1.63	1.65	1.66
1.8	1.10	1.10	1.11	1.13	1.16	1.20	1.25	1.31	1.39	1.42	1.43	1.46	1.50	1.55	1.60	1.67	1.74	1.78	1.80
2.0	1.07	1.07	1.09	1.11	1.14	1.18	1.23	1.30	1.38	1.42	1.44	1.46	1.51	1.58	1.66	1.75	1.85	1.93	1.96
2.2	1.05	1.06	1.07	1.09	1.12	1.16	1.22	1.29	1.38	1.42	1.44	1.47	1.52	1.60	1.70	1.83	1.97	2.00	2.00
2.4	1.04	1.04	1.06	1.08	1.11	1.15	1.21	1.28	1.37	1.42	1.44	1.48	1.54	1.62	1.74	1.89	2.00	2.00	2.00
2.6	1.03	1.03	1.05	1.07	1.10	1.15	1.20	1.28	1.37	1.42	1.44	1.48	1.54	1.64	1.77	1.96	2.00	2.00	2.00
2.8	1.02	1.03	1.04	1.06	1.10	1.14	1.20	1.27	1.37	1.42	1.44	1.48	1.55	1.65	1.79	2.00	2.00	2.02	2.00
3.0	1.02	1.02	1.04	1.06	1.10	1.14	1.20	1.27	1.37	1.42	1.44	1.48	1.55	1.65	1.81	2.00	2.00	2.01	2.00
3.2	1.01	1.02	1.03	1.06	1.09	1.14	1.20	1.27	1.36	1.42	1.44	1.48	1.55	1.66	1.82	2.00	2.00	2.01	2.00
3.4	1.01	1.02	1.03	1.06	1.09	1.14	1.20	1.27	1.36	1.42	1.44	1.48	1.56	1.66	1.83	2.00	2.01	2.01	2.00
3.6	1.01	1.01	1.03	1.06	1.09	1.14	1.19	1.27	1.36	1.42	1.44	1.48	1.56	1.67	1.83	2.00	2.01	2.01	2.00
3.8	1.01	1.01	1.03	1.06	1.09	1.14	1.19	1.27	1.36	1.42	1.44	1.48	1.56	1.67	1.84	2.00	2.02	2.01	2.00
4.0	1.01	1.01	1.03	1.06	1.09	1.13	1.19	1.27	1.36	1.42	1.44	1.49	1.56	1.67	1.84	2.00	2.02	2.01	2.00

Table 3. Wind-erosion direction factor for rectangular fields with length/width ratio of 4.

Pre-	Angle of deviation in degrees																		
ponderance	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
1.0	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48
1.2	1.30	1.30	1.31	1.32	1.34	1.36	1.38	1.41	1.45	1.48	1.52	1.56	1.61	1.65	1.68	1.71	1.73	1.75	1.76
1.4	1.20	1.20	1.21	1.23	1.25	1.28	1.32	1.37	1.42	1.48	1.55	1.63	1.72	1.81	1.90	1.98	2.00	2.00	2.00
1.6	1.14	1.14	1.15	1.17	1.20	1.23	1.28	1.34	1.40	1.48	1.58	1.69	1.82	1.96	2.00	2.06	2.30	2.34	2.35
1.8	1.10	1.10	1.11	1.13	1.16	1.20	1.25	1.31	1.39	1.48	1.60	1.73	1.90	2.00	2.15	2.37	2.45	2.52	2.55
2.0	1.07	1.07	1.09	1.11	1.14	1.18	1.23	1.30	1.38	1.48	1.61	1.77	1.96	2.00	2.34	2.48	2.62	2.74	2.78
2.2	1.05	1.06	1.07	1.09	1.12	1.16	1.22	1.29	1.38	1.48	1.62	1.80	2.00	2.00	2.41	2.59	2.79	2.98	3.06
2.4	1.04	1.04	1.06	1.08	1.11	1.15	1.21	1.28	1.37	1.48	1.63	1.82	2.00	2.29	2.46	2.68	2.96	3.23	3.35
2.6	1.03	1.03	1.05	1.07	1.10	1.15	1.20	1.28	1.37	1.48	1.63	1.83	2.00	2.32	2.51	2.77	3.11	3.48	3.58
2.8	1.02	1.03	1.04	1.06	1.10	1.14	1.20	1.27	1.37	1.48	1.64	1.84	2.00	2.33	2.54	2.85	3.26	3.59	3.74
3.0	1.02	1.02	1.04	1.06	1.10	1.14	1.20	1.27	1.37	1.48	1.64	1.84	2.00	2.34	2.56	2.89	3.41	3.73	3.92
3.2	1.01	1.02	1.03	1.06	1.09	1.14	1.20	1.27	1.36	1.48	1.64	1.85	2.00	2.35	2.58	2.93	3.46	3.86	4.00
3.4	1.01	1.02	1.03	1.06	1.09	1.14	1.20	1.27	1.36	1.48	1.64	1.85	2.00	2.35	2.59	2.95	3.49	4.00	4.00
3.6	1.01	1.01	1.03	1.06	1.09	1.14	1.19	1.27	1.36	1.48	1.64	1.85	2.00	2.36	2.60	2.97	3.52	4.00	4.00
3.8	1.01	1.01	1.03	1.06	1.09	1.14	1.19	1.27	1.36	1.48	1.64	1.85	2.00	2.36	2.60	2.99	3.54	4.01	4.00
4.0	1.01	1.01	1.03	1.06	1.09	1.13	1.19	1.27	1.36	1.48	1.64	1.86	2.00	2.36	2.61	3.00	3.55	4.01	4.00

RESULTS AND DISCUSSION

The wind-erosion direction factor is a dimensionless number that, when multiplied by field width, yields median travel distance. The median travel distance represents the equivalent flow length of the entire field, the equivalent field length of Woodruff and Siddoway (1965), and is used in the wind-erosion equation to predict wind erosion and to design wind-erosion control practices.

The wind-erosion direction factors for several combinations of preponderance and angles of deviation of prevailing wind-erosion direction from perpendicular to field length with length/width ratios of 2, 4, and 10 are shown in Tables 2 to 4, respectively.

When preponderance was 1.0 (lowest value possible—wind equal from all directions), the wind-erosion direction factor was not influenced by field orientation and had the values of 1.03, 1.42, 1.48, and 1.48 for rectangular fields with length/width ratios of 1, 2, 4, and 10, respectively. As preponderance increased, the wind-erosion direction factor approached unity for small angles of deviation and approached the length/width ratio for large angles of deviation. Also, for high preponderances, wind-erosion direction factors were approximated by the length of MAC (compare last lines of Tables 2–4 with those of Fig. 3).

The results of this analysis extend and improve an earlier analysis (Skidmore, 1965; Skidmore et al., 1970), in which only long field strips were considered, approximated here by a length/width ratio = 10. In that earlier analysis, deviations of incident wind up to 50° were considered, wind-erosion roses had 16 vectors instead of 72, and the analysis was based on only a few actual wind-erosion roses. Each of these differences influenced the results.

The wind-erosion direction factors for square fields, length/width ratio of 1.0, differ considerably from those for long, narrow fields. Square fields surrounded by nonerodible areas are much like circular fields. The consequence of preponderance and angle of deviation is slight, whereas the wind-erosion direction factor for fields with large length/width ratios depend greatly on both preponderance and deviation angle (Table 4).

The logic in the previous analysis for using deviation angles only up to 50° was that after 45° one could switch what was called field length by field width, and the deviation angle would be <45°.

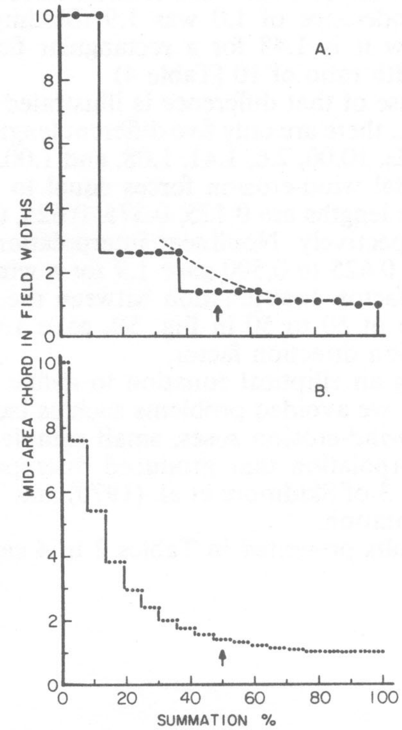

Fig. 5. Frequency distribution of midarea chords for a rectangular field with length/width ratio of 10: (A) 16 chords, (B) 72 chords.

It is more reasonable to define the narrow-dimension field width and the long-dimension field length in multiples of field width. In such a case, we may have deviation angles from −90 to +90° from a right angle to field length; hence, the reason for extending the angle of deviation to 90°. Wind-erosion direction factor of a negative angle is the same as for a positive deviation.

Because the axis for the ellipse was rotated in 5° increments to simulate deviation of prevailing wind-erosion direction from a right angle to field length, it was necessary to use vectors of the wind-erosion roses at 5° increments, also. Using 72 instead of 16 vectors (in the previous analysis) caused slightly different re-

Table 4. Wind-erosion direction factor for rectangular fields with length/width ratio of 10.

Preponderance	Angle of deviation in degrees																		
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
1.0	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48
1.2	1.30	1.30	1.31	1.32	1.34	1.36	1.38	1.41	1.45	1.48	1.52	1.56	1.61	1.65	1.68	1.71	1.73	1.75	1.76
1.4	1.20	1.20	1.21	1.23	1.28	1.25	1.32	1.37	1.42	1.48	1.55	1.63	1.72	1.81	1.90	1.98	2.00	2.00	2.00
1.6	1.14	1.14	1.15	1.17	1.20	1.23	1.28	1.34	1.40	1.48	1.58	1.69	1.82	1.96	2.00	2.08	2.41	2.51	2.55
1.8	1.10	1.10	1.11	1.13	1.16	1.20	1.25	1.31	1.39	1.48	1.60	1.73	1.90	2.00	2.19	2.58	2.82	3.00	3.08
2.0	1.07	1.07	1.09	1.11	1.14	1.18	1.23	1.30	1.38	1.48	1.61	1.77	1.96	2.00	2.52	2.88	3.29	3.61	3.73
2.2	1.05	1.06	1.07	1.09	1.12	1.16	1.22	1.29	1.38	1.48	1.62	1.80	2.00	2.00	2.69	3.18	3.75	4.26	4.47
2.4	1.04	1.04	1.06	1.08	1.11	1.15	1.21	1.28	1.37	1.48	1.63	1.82	2.00	2.39	2.83	3.44	4.20	4.92	5.22
2.6	1.03	1.30	1.05	1.07	1.10	1.15	1.20	1.28	1.37	1.48	1.63	1.83	2.00	2.45	2.96	3.69	4.61	5.54	5.93
2.8	1.02	1.03	1.04	1.06	1.10	1.14	1.20	1.27	1.37	1.48	1.64	1.84	2.00	2.49	3.05	3.91	5.00	6.07	6.61
3.0	1.02	1.02	1.04	1.06	1.10	1.14	1.20	1.27	1.37	1.48	1.64	1.84	2.00	2.52	3.11	4.03	5.39	6.57	7.28
3.2	1.01	1.02	1.03	1.06	1.09	1.14	1.20	1.27	1.36	1.48	1.64	1.85	2.00	2.54	3.15	4.12	5.56	7.08	7.79
3.4	1.01	1.02	1.03	1.06	1.09	1.14	1.20	1.27	1.36	1.48	1.64	1.85	2.00	2.55	3.18	4.19	5.68	7.57	8.17
3.6	1.01	1.01	1.03	1.06	1.09	1.14	1.19	1.27	1.36	1.48	1.64	1.85	2.00	2.56	3.21	4.24	5.77	7.72	8.54
3.8	1.01	1.01	1.03	1.06	1.09	1.14	1.19	1.27	1.36	1.48	1.64	1.85	2.00	2.57	3.23	4.28	5.85	7.82	8.91
4.0	1.01	1.01	1.03	1.06	1.09	1.13	1.19	1.27	1.36	1.48	1.64	1.86	2.00	2.58	3.24	4.32	5.91	7.91	9.27

sults. For example, the wind-erosion direction factor for preponderance of 1.0 was 1.9 (Skidmore et al., 1970); now it is 1.48 for a rectangular field with a length/width ratio of 10 (Table 4).

The cause of that difference is illustrated by Fig. 5. In Fig. 5A., there are only five different lengths of mid-area chords: 10.00, 2.6, 1.41, 1.08, and 1.00. The fraction of total wind-erosion forces equal to or greater than those lengths are 0.125, 0.375, 0.625, 0.875, and 1.000, respectively. Nonlinear interpolation between 0.375 and 0.625 to 0.500 gave 1.9 for a wind-erosion direction factor. Interpolation between the points on either side of 50 to 50 in Fig. 5B. gave 1.48 for the wind-erosion direction factor.

By using an elliptical equation to define wind-erosion roses, we avoided problems such as lack of symmetry of wind-erosion roses, small sample size, and crude interpolation that produced discrepancies between Fig. 3 of Skidmore et al. (1970) and Table 4 of this presentation.

The results presented in Tables 2 to 4 can be used to predict soil loss from wind erosion and to design wind-erosion control practices. Prevailing wind-erosion direction and preponderance of wind-erosion forces in the prevailing wind-erosion direction are given for many locations in the USA in another publication (Skidmore and Woodruff, 1968).

If preponderance and prevailing wind-erosion direction are not given for the desired location, they may be calculated from wind summaries of climatological data by methods described elsewhere (Skidmore, 1965).

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