HONEY FLOW AND CLIMATE IN NORTH AND CENTRAL EUROPE

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Everywhere that flowers bloom and nectar flows, bees and beekeeping also exist. In Norway and Sweden for example holding apiaries stretch northward as far as 65^{O} parallel, producing, in spite of the short season (June/July), honey crops competing with those of Central Europe. It is true that in the European regions having honey sources at lower latitudes, a longer period of warm weather exists, but certain climatic effects occur such as those following drought, or the effects entailed by a lower flowering activity, etc, all this substantially reducing the flow period. For instance, the differing day-light and warm periods, entail in high latitudes a shorter flow season limited to the time during which the sun is the highest in the sky, while in low latitudes – there is a general transfer of the flow to the first half of summer.

To this climatic effect caused by latitude, corresponding in Europe to the monsoon effect – manifest in zonal direction from North Atlantic to the continent; its maritime and respective continent levels entail climatic differences in flow conditions. This West-East effect originates in the differences between the land and ocean getting warm in spring and summer – causing differences in flow, the latter entailing temporary favouring of the European ocean coast zone in early spring and at its height; but, later on, the favoured zones are the continental ones.

Daily records for several years of control hives, necessary for a general outline in connection with such a large zone as Central and North Europe, do not exist but in a few countries. The data we shall deal with below were obtained mostly by the courtesy of a number of people responsible for national associations, as well as from several individual beekeepers; in fact, they are the outcome of years of endeavour of investigators in various countries, working disinterestedly in their observation apiaries every day.

In the territory of the German Democratic Republic, 5 types of honey flow are identified throughout the year, characterized by 4 main honey plant sources: (1) early and late flowering winter rape, (2) acacia, (3) forest plants, and (4) white clover and lime tree. These main types exist throughout Central and North Europe. The GDR lacks only large stands of lime trees (North-west and South Germany) and of fir trees (North Alps, Switzerland, the Black Forest, The Vosges, etc.), and also a number of special flows which are not main types, flows existing especially in hot summer regions in Central Europe (sweet chestnut, woodsage, red clover, etc).

The thorough investigations made by F. Schnelle using tables, maps, and relevant literature – on the European phenology most accurately show the climatic planetary (day light) and monsoon effects mentioned above.

a) The Beginning of spring and early (premature) **springs** (sowing of summer cereal crops) cross Europe from SSW to NNE. Early blooming flower zones exist in Soutli – Mediterranean Sea -, and in West – Atlantic -, and precede by about 3 months the “late” zones in North-Eastern Europe.
b) The warming of the continents, starting in April, is accomplished in May when frosts do not occur at night; it entails a general warming of the European continent and hence a faster development, the spring being thus caught up. Just as the peninsulas in South Europe, the lower Danube regions and the Carpathian regions become increasingly “earlier” from the point of view of vegetation. The **beginning of summer** occurs in Europe – from South to North – along 70 days.
c) At the **height of summer**, early flow regions follow successively from East to North. During winter wheat harvesting, these zones advance like a wedge of early flows from South and Central Russia to west, to the lower course of Oder river. Europe is crossed this time from SSE to NNW.
d) **Autumn**. During winter wheat sowing, the early flow regions are – unlike in spring – those in North-East, while the late flow regions are those along the Mediterranean coast. The lapse of time now is about 90 days, and the direction – NE – SW. The whole spontaneous vegetation in early winter regions flower earlier so that seed ripening is secured. Further on, the earlier flowering effect in early winter regions – like for example the case of field flowers – is tellingly illustrated.

Because of the shorter, warm period in summer in northern latitudes, the period of time favourable to vegetation is considerably reduced. In the “early” South-east European regions for example, this period ranges between the spring sowing of summer cereal crops and the sowing of the winter wheat in autumn, which means 260 days, while in the “latest” North-eastern European regions – only 100 days; the difference is of 5 to 6 monts !

In central Norway, in 64^{O} northern latitude, the period between the beginning of the early fruit-tree flow and the end of the field flower flow lasts for 21/2 – 3 months, while in Southern France – for 51/2 – 6 months. There are years with longer or shorter flow season. On the whole, the data recorded concerning the

length of the flow season in Europe correspond to the knowledge on plant phenology, except the numerous zonal variations which can not be generalized.

1. THE FLOW IN EXCLUSIVELY AGRICULTURAL REGIONS (Fig. 1)

In the regions with intensive agriculture, usually fruit-trees, cereal, root plant and oleaginous crops, the honey flow mainly consist of: dandelion, fruit-tree blossom, winter rape, white clover and the occurring wild flowers. The high temperature, in this case – the decisive factor for agricultural production – drops significantly with the higher altitudes; especially the daily average values decrease when sun is lower in the sky. But, on the long sunny days in June and July, the temperature is higher in the morning and the evening, so that for one to two months the average daily temperature even close to the polar circle is similar to that in Central Europe – where, in that period, the days are shorter. Hence, colonies are delayed in their development and benefit of a short flow season; nevertheless, the abundant clover flowers supply them with great amounts of nectar.

Considering now regions along the North-South direction, we examined the Norwegian stations in the continental zone (Fig. 1-1.1; 1.2; 1.3); we noted a difference which entailed better nectar yield: from early June to mid May, starting from Tröndelag (Maere) to Oslo firod (Sandör). In Maere, bees have neither benefit of fruit-tree blossom nor of dandelion; these are precisely the plants which in Östlandot – South Norway – are in bloom in the second half of May and early June.

At the Gross-Schoritz station on Rügen (1, 4), after a later start of spring, phenologically, a climax exists in early June, and a second one – wild flower and white clover flow – in June and July. The similarity with the situation in South Norway is obvious. In the Inland fertile regions, more continental ones, with farm crops in the Southern region of the GDR (1, 5) the climax of rape flow – hence the absolute annual climax – is exactly in mid May.

The Swiss observation station Turbenthal/Zürich (1, 6) is located in an early phenologic region being one of the “earliest” regions with early flows in Central Europe.

The main flow is supplied by fruit-tree blossom and dandelion and lasts the latest till May 20. Although pine-tree forests exist, only silver fir trees supply scarce flow in the first half of July (6)

As the farm crops supply the most important flow in Central Europe, the advancing of the main flow towards spring has a decisive role for almost the whole of beekeeping in central Europe.

2. THE FLOW IN AGRICULTURAL REGIONS WITH MARITIME AND CONTINENTAL CLIMATE (Fig. 2)

We wish to illustrate with examples how the maritime and continentality West-east monsoon effect superimposes on the planetary effect. To this end, we considered 4 pairs of stations, in 63^{O}, 60^{O}, 51^{O}, and $47\text{-}48^{O}$ North latitude.

In the far North, the harbour Trondheim (2, 1, a) is different from the 2 observation stations at 100 km far to the North-east and on the continent – Maere and Steinkjer (2, 1, b) – by the existence of dandelion and raspberry; due to the steep rise of temperature in the two stations on the continent, the main and unique flow is supplied by clover; this does not apply to the cold climate along the coast. A similar situation exists in the Hordaland fiord region, near Bergen (2, 2 a) where fruit-tree blossoms and dandelion supply a scarce early flow in May, but afterwards no flow exists till the blooming of the field plants at the end of July. Unlikely, in the continental Östlandet (2, 2 b), the heaviest flow of raspberry and various clovers species, and possibly rape and lime tree – occurs only as late as mid June and lasts till mid July.

In European medium latitudes, from West to East, farm crops also differ. The winter rape, originally a wild plant in the limited coast region and related to the maritime climate, disappears soon, as one draws eastward and south-eastward of GDR, and thus having no forests, the agricultural regions have in fact no flow – besides fruit tress, acacia and lime tree.

The experimental stations in Eastern Slovakia (Fig. 2, 3 b) obtain the honey crop in July from buckwheat which in Germany has disappeared almost completely. Here, just as with rape crops, in the GDR only one climax actually exists, which points to the fact that without migratory beekeeping possibilities for apiculture in the steppes under crops are slight without forests and wild flowers.

Finally, as examples of the “maritime” west and “continental” east, we compared the regions with early blossoming fruit trees in central Switzerland (2,4 a) to the steppes under crops, with hot summers in South-Eastern Slovakia (2,2 b) with a weak flow supplied by acacia and wild plants. Just like the station pairs 2,1; 2,2; 2,3, the height of the flow in Switzerland is in May, while in Slovakia, where May is usually flowless, in June.

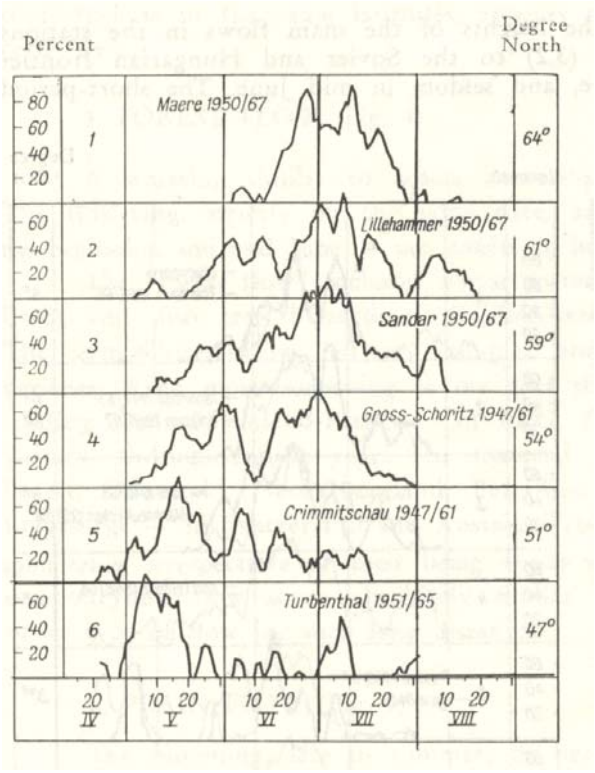

Fig. 1 – Main flow periods in regions under farm crops. Flow curves in stations in North and Central Europe, from North to South.
1. North – Tröndelag Central Norway; 2 – Oppland; 3 – Vestfold Norway; 4 – Rügen island; 5 – Saxony; 6 – Central Switzerland (Zürich)

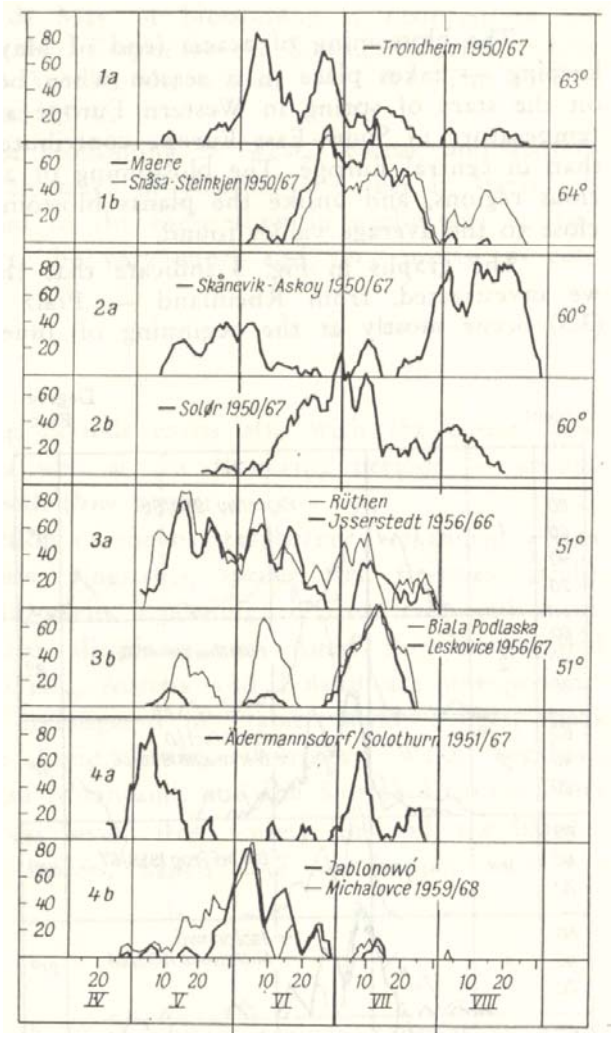

Fig. 2 – Different beginning dates of flow in maritime and continental climatic regions. Flow curves of stations in North and Central Europe, at the same altitude, placed in pairs one against the other.
1. Central Norway: a – Fiord, b – Inland; 2 – South Norway: a – Schären in Nordaland - b Hedmark; 3 – Westphalia, Thuringia; 3. b – Eastern Central Poland; 4. a – Central Switzerland (Solothurn); 4. b- South Slovakia)

3. ACACIA FLOW (Fig. 3)

The blossoming of acacia (end of May – mid June) – highly significant for beekeeping – takes place in a season when both the maritime influence bearing positively on the start of spring in Western Europe and the continental influence entailing rise of temperature in South-East Europe contribute to the same extent to flows starting earlier than in central Europe. The blossoming of acacia occurs at slightly different times in various regions, and unlike the plants blossoming in spring – it blossoms in periods very close to the average values found.

The graphs in Fig. 3 indicate that the heights of the main flows in the stations we investigated, from Rheinland – Pfalz (3,2) to the Soviet and Hungarian frontier (3,5) occur mostly at the beginning of June, and seldom in mid June. The short-period but abundant blossoming of acacia materializes in two very marked climax values. The statistical reliability of these two unique cases of favourable flow both before and after the "second monsoon M_2" (12, VI. after Flohn/4) guarantees with precision the success of this flow source.

At Mikhalovche/South-east Slovakia (3,5) the first evidence is manifest of more advanced (earlier) acacia blossoming, namely in May, in South-east Europe, illustrated by the ascending curve starting May 15. Even earlier in May is the height of the acacia flow in Neusidler lake region (3,6), where, due to the great heat in the Pannoian region, the main height of the flow occurs much earlier – 22 V, and the second one – 6 VI. Finally, in West Hungary (3,7) acacia blossoming ranges between May 5 and June 5, and ends between May 20 and June 15. In that region, lime tree is slightly important.

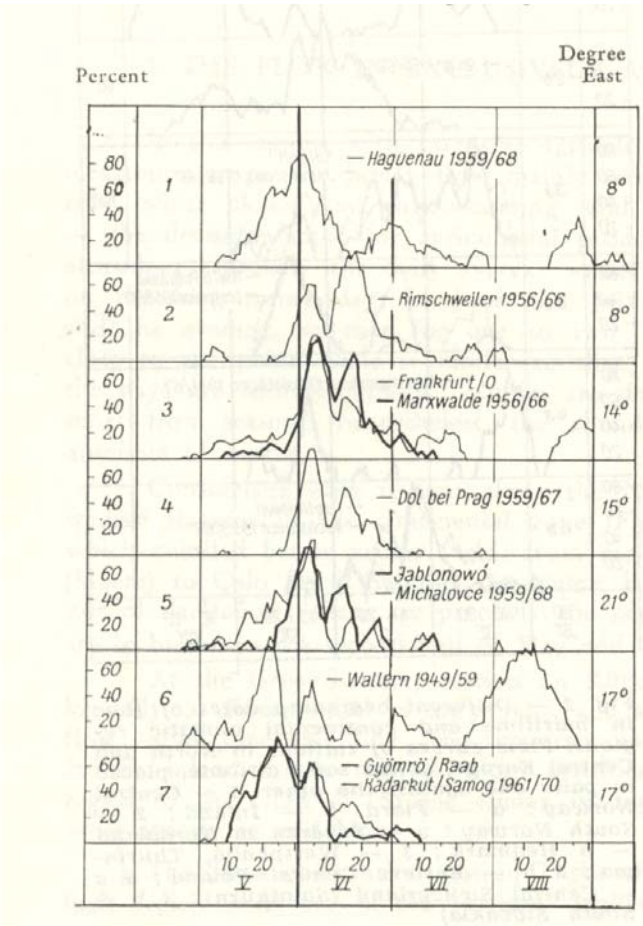

Fig. 3 – Main acacia flow periods. Flow curves of stations in Central Europe, from West to East.
1. Alsace; 2. North Palatine; 3. Oder; 4. CSR – Bohemia; 5. South Slovakia; 6. Burgenland/Austria; 7. West Hungary

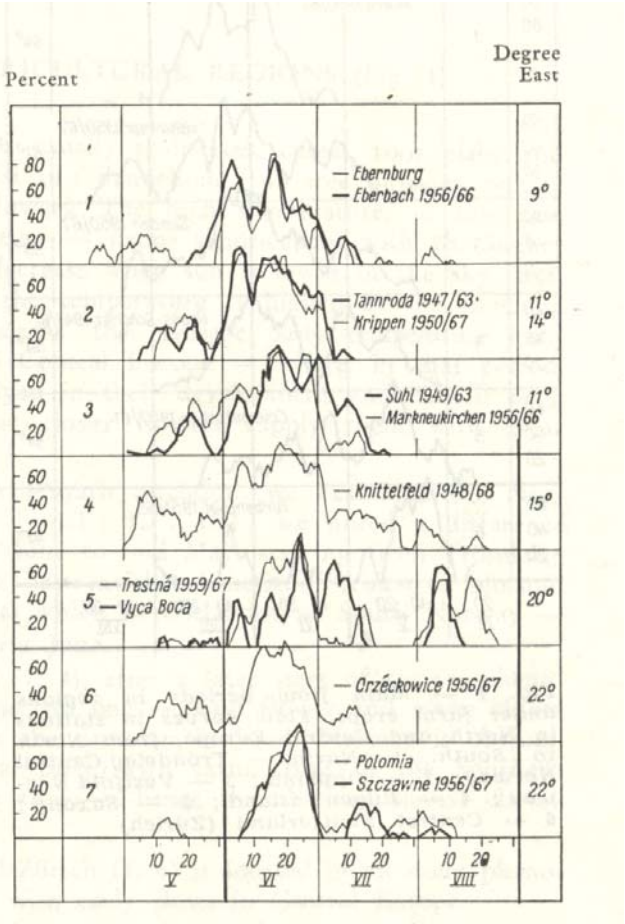

Fig. 4 – Main forest flow periods. Flow curves of stations in Central Europe, from West to East.
1. North Palatine; 2. Thuringia and Saxon Switzerland, low altitudes; 3. Thüringer Wald and Volgland, medium altitudes; 4. Steiermark 620 m; 5. Slovakia; 6. South-East Poland; 7. South Poland

A similar tendency of advance towards May of blossoming is manifest in the west zone of central Europe, starting from central France to the Southern France, where the first height of acacia flow is around 23 V, and the second – 3 VI. This fact is conditioned by the abundant blossoming around 15 V.

We can state in conclusion that acacia blossoming in West, central, and Eastern Europe ranges between 10 V and 20 VI (irrespective of whether the year is “early” or “late”), period of time which, when compared to the early flow in exclusively agricultural regions in the same latitudes, appears to be very short and very precise as concerns date.

4. FOREST FLOW (Fig. 4)

A situation similar to acacia flowering periods exists also with the forest flow. The flowering, strictly on the same date, as well as the flowering periods – around the beginning and mid June – are similar to both flow types.

The “forest flow” includes nectar secretion of shrubs (raspberry, buckthorn, willow herb) and also tree honeydew (decidous-trees, pine-trees, spruce firs, fir-trees, larch). The term “forest flow” is very complex and varies according to fruit tree and shrub varieties. Even more surprising is the fact that all places with forest flow investigated starting from Rheinland-Pfalz, - in FRG, GDR, Austria and Poland are unexpectedly unitary, throughout the year. The material investigated in Pfälzer Wald, Vosges, Black Forest, Odenwald, Neckarbergland, Bergishen Land, Harz, Thüringer Wald, Vogtland, Erzgebirge – in Switzerland and Austria, Tatra Mountains, and the Slowak Krushne Hory mountains, irrespective of their being above sea level, tree variety or soil, the blossom or honeydew flow is an absolutely similar process, which does not happen with any other type of flow for such long distances.

5. PLAIN FLOW (Fig. 5)

The blooming, late in summer, of heath in the plains regions, supplies an abundant flow which announces, several weeks previously, the beginning of winter. In the northern latitudes of Scandinavia (and in North-eastern Europe) one finds the early flow regions, while in South-western France and in Spain – the late flow regions. Hence, a shifting takes place, from Norway, through GDR to Southern France, of the plain flow, from July/August to September/October, by 1½-2 months. Consequently, nature constantly secures enough warm weather for the blossoming and ripening of small plain shrubs, before the frost period starts.

Fig. 5 includes the flow diagrams for two groups of Norwegian stations (5,1; 5,2), for three groups of the GDR, and for one station in "landes", South of Bordeaux. The early flow in Norway beginning around July 20, is one month earlier than the blossoming of the plain vegetation in central Europe, and ½ month earlier than the ascending line for South-western France. In GDR, the plains are vestiges of continental plains, with spruce firs and wild vegetation under them; in the zones far away from the coast, the Atlantic plains without forests could not be maintained, as was the case with Lüneburg plains. The Sabres observation station lies in the large and even expanses behind the coast, north of Pirinei mountains, in the middle of a vast plain region, which may be considered the secondary Atlantics plain heath, in a place where oak tree stands existed previously.

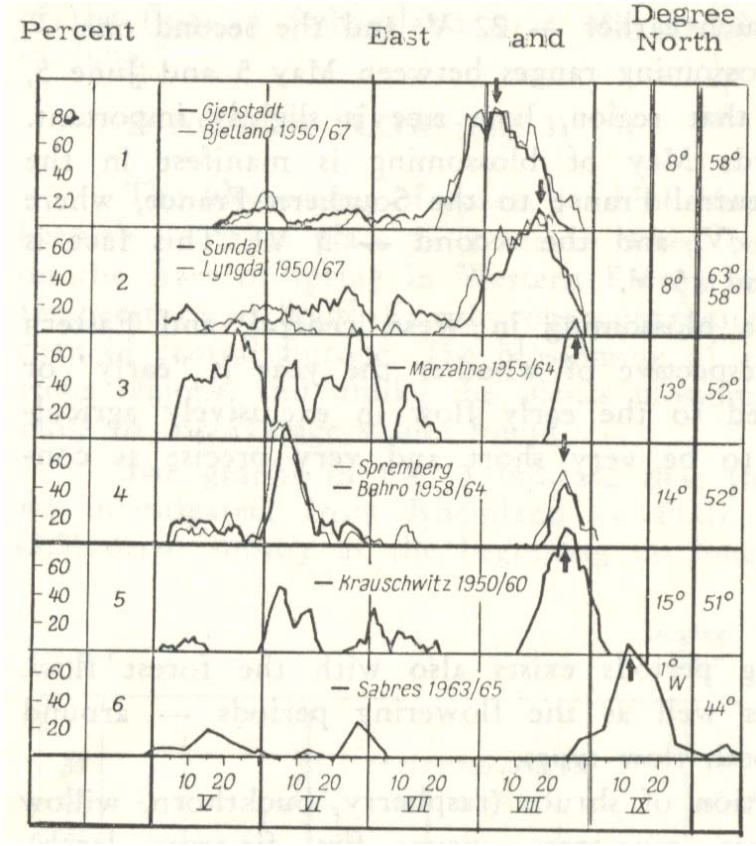

Fig. 5 – Main flow periods in the plain. Flow curves at stations in Central and West Europe, from North to South.
1. South Norway, stations far away from the coast; 2. Central and South Norway, stations in fiords; 3. Fläming GDR; 4. Niederlausitz GDR; 5. Oberlausitz; 6. Les Landes/South-East France.

Another climate effect appears in the plains flow, an effect which is important for the autumn phonological phenomenon – especially in Norway; the beekeepers in the vast plain zones on the western coast (the small rocky islands and fiords) and in the South said that close to the coast the plains would be in blossom about 10 lays later than on the islands and continent. This fact is confirmed by the flow diagrams made by the Norwegian observation staff; these diagrams clearly illustrate two groups: one, whose curves are precisely limited and which, belong to the pure maritime climate on the coast, ascend and descend respectively 10-14 days later (5,2) than the curves of the continental observation stations and far away from the coast (5,1). The arrows in 5,1 and 5,2 illustrating in Fig. 5 the height of the flow, are at 15-day interval far from one another.

The inland stations, obviously continental, around and North of Oslo, have the early height around 6.VIII, but also a late flow, with a fast end of the flow. Hence the plain flow is substantially shorter, not by far so abundant, and much less important. Nevertheless, migratory beekeeping is practised there too, and the plains blossom is made use of up to 1000 m heights.

The climate range of Europe is not very large as compared to other continents, and in fact Europe is a structured peninsula, breaking up on the Atlantic coast of the continent of Eurasia. It is precisely for this reason that the multitude of its flower, phenological, agricultural, forest and orchard structures is amazing. Beekeeping mirrors all these physical conditions in such an impressive manner, that we considered it important to draw the attention of beekeepers in Europe to this tremendous intertwining of various natural factors.

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