AN

ESSAY

ON THE

Climate of the United States:

OR,

AN INQUIRY INTO THE CAUSES OF THE DIFFERENCE IN CLIMATE BETWEEN THE EASTERN SIDE OF THE CONTINENT OF NORTH AMERICA AND EUROPE.

WITH

Practical Remarks on the Influence of Climate on Agriculture, and particularly the cultivation of the Vine.

.....Rerum cognoscere causas.—VIRG.

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HE who communicates to the public his thoughts on topics of a general nature, is presumed to do it under a belief that they will convey pleasure or instruction. Of these two objects, the writer of the following sheets can only have the latter in view; and though not very sanguine in his expectations of attaining it, he is not without hope that they may be the means of exciting the attention of others, who have more leisure and are better qualified for such disquisitions than himself, to a subject which appears not to have received the consideration which it merits.

Engaged in the pursuits of active life, he has had little inclination, and less leisure for speculative inquiries; but having for a number of years past devoted a portion of his time to the practice of agriculture, he was led to a comparison of the modes of cultivation followed in this country with those of Europe, as detailed by different writers: this naturally led to a consideration of the influence of climate. On this subject it seemed to him that writers, otherwise of undoubted merit, had taken up opinions in some respects erroneous; and being accustomed to commit to paper such ideas as occurred to him from time to time, on this, as well as other topics connected with the art of husbandry, he

found, on reviewing his notes, that with very little labour they might be thrown into their present form. Had his leisure permitted, his local situation would not have enabled him to consult many books on the subject: among those that have fallen in his way, Young's Travels through France, Kirwan's Essay on the Temperature of different Latitudes, and Volney's View of the Climate and Soil of the United States, are those from which he has derived the most information. If he has added any thing to the stock of useful knowledge, it will afford him satisfaction to have contributed his mite to the public good; and if not, he will console himself in the reflection that this will be attended with no other evil consequence than that of adding one to the number of useless publications; and that, if he does not merit praise, he is not obnoxious to any severity of censure.

AN ESSAY, &c.

THAT the eastern coast of North America is subject to greater extremes of heat and cold than the opposite shores of Europe, is a fact that has long since been ascertained, and it may perhaps have been accounted for; but I am inclined to believe that the true cause of this difference, if it has been assigned, is not well understood among those who are most conversant with subjects of this nature.

It is a generally received opinion that the climate of Europe has been rendered more mild by the progress of cultivation, and from hence it is very naturally inferred that the same cause will produce the same effect in America; and that in proportion as the forests disappear and give place to cultivated fields, the winter's cold, if not the heat of summer, will become less intense.

This reasoning, however, is not conclusive: the same cause, when combined with other circumstances, may produce a different, or even a contrary effect; and if the conjectures which have occurred to me are founded on truth, the woods of America may be cleared, and

the country brought to the highest state of improvement, and the climate yet remain unaltered.

While it is admitted that the countries of Europe in general enjoy a more temperate climate than that of the United States or the British colonies in North America in the same parallels of latitude, it is equally certain that the eastern parts of the old continent bear in this respect a striking resemblance to those of the new. The city of Pekin, which is nearly in the latitude of Philadelphia, is no less subject to extremes of heat and cold, perhaps more so, than the latter city, and the cold of Kamschatka rivals that of Hudson's Bay.

The western parts of North America are not so well known; but, from the accounts of voyagers, the climate of those regions (except perhaps the most northern which approach very near the coast of Asia) much more nearly resembles that of Europe, than that of the United States and the British American provinces.

From this remarkable coincidence in both instances, we may fairly infer that there is no reasonable ground to expect any great change of climate from the progress of cultivation. If it is to produce such an effect on the eastern coast of the new continent, how has it happened that China, which occupies so great a portion of the eastern side of the old, which was cleared of its forests and brought to the highest state of improvement while Europe was covered with woods, and which has always continued to maintain its superiority both in population and the art of husbandry, should after the lapse of thousands of years be subject to as great ex-

tremes of heat and cold as the forests of North America? And to what cause is it owing, that the uncultivated wilds on the western side of North America, bear so great a resemblance, in point of climate, to the highly improved countries of Europe?

This similarity of climate between the eastern parts of the old and the new continent as well as the western, must be attributed to some cause of a general and permanent nature, nearly uniform in its operations, and one that in all probability may be expected to produce the same effects, so long as the present constitution of our globe exists.

In an inquiry into this cause, the difference of climate between the sea and land naturally presents itself to our consideration. The temperature of the air on the main ocean, has been observed to be much more equable than that of either continent, in the same parallels of latitude.

Islands surrounded by the sea partake of its temperature, and accordingly the British islands enjoy a much more temperate climate than the neighbouring parts of the continent of Europe.

Paris is about 160 geographical miles south of London, yet it has been found, by a long series of observations, to be subject to greater extremes of cold as well as heat.

The reason which has been assigned for this diversity, and which seems sufficiently to account for it, is the difference between the surface of the land and that of the water; the former being always the same, be-

comes more and more heated by the sun in summer, and cooled by the frosts in winter, and communicates its temperature to the surrounding atmosphere; while the ocean being in perpetual motion, its surface is continually changing, and it imparts coolness to the air in summer, and warmth in winter.

If the globe were wholly covered with water, the extremes of heat and cold would generally be much less than at present.

The temperature of the air being affected by the warmth or coolness of the surface it passes over, a current of air passing over the sea will generally be warmer in winter and cooler in summer, than another current passing over the land in the same latitude. Bodies once heated require some time to become cool, and *vice versa:* the air follows this general law of nature, and accordingly a sea breeze in summer imparts coolness, and a wind from the same quarter generally brings warmth in winter.

These reasons account sufficiently for the superior mildness of climate generally experienced in those countries that border on the sea coast, but not for the difference in this respect between the climate of Europe and that of the eastern coasts of Asia and America in the same latitudes.

The geographical position of the countries of Europe, deeply indented by seas, no doubt contributes in some degree to this difference; but I think cannot be considered as the sole, probably not the principal cause. The island of Newfoundland lies further south than

England, yet it is without comparison colder in winter, and perhaps warmer in summer: besides, how shall we account for the superior mildness of climate of the western coasts of America, not so deeply indented with bays of the sea as the eastern, yet certainly enjoying a climate much more temperate.

If, on the eastern coasts of both the new and the old continent, the winds should be found to blow generally from the land, and on the western coasts from the sea, this circumstance would of itself be sufficient to account for this difference.

The sea air would impart warmth in winter and coolness in summer to the western parts of both continents; while, on the eastern shores of both, the summer's heat as well as the cold of winter would be greatly increased by the land winds passing over a heated surface in the one season and a frozen surface in the other.

That such is the fact I cannot take upon me positively to assert, not having had an opportunity of consulting a sufficient number of journals of the weather to speak with certainty on the subject; but several writers, who have collected the results of those journals, concur in stating, that both on the eastern side of the North American continent and on the coasts of Europe westerly winds predominate. The air in these regions of America, passing most generally over a surface frozen in winter, and heated in summer to a high degree, necessarily partakes of these extremes, and hence the

excessive cold of our winters and the intensity of our summers' heat.

In the countries on the coasts of Europe the same cause produces an opposite effect; the same winds, passing over the surface of the Atlantic, bring with them the temperature communicated by the waters of the ocean.

Assuming this prevalence of the western winds as a fact established, let us proceed one step further in this inquiry, and endeavour to ascertain its cause. I think it may be found in the trade winds.

Between the tropics these winds are known to blow with great uniformity across the Atlantic and Pacific oceans from east to west. If this current of air met with no interruption in its course, but swept round the whole circumference of the globe, it would feed itself; and the same particles of air would pursue their course to the west until they arrived at the point from whence they were first put in motion. But this is known not to be the fact; the current that begins at no great distance from the western coast of America, after passing over the Pacific ocean, is checked in its course by the continent of Asia and its numerous and extensive islands, and finally arrested by the eastern coast of Africa.

That which passes over the Atlantic begins at no great distance from the western shores of Africa, and, sweeping across the whole breadth of the Atlantic into the bay of Mexico, its further progress is stopped by the American continent.

Several reasons have been given why the trade winds,

which so uniformly prevail on the ocean, should be checked in their course by the continent: the fact being certain, the cause is of no importance in the present inquiry.

But to whatever cause they may be attributed, they must receive a constant supply at the points near the western shores of Africa and America, where they respectively begin their course; and as the air cannot constantly accumulate at its termination, it must pass off in some other direction. The current of air which begins on the western coast of Africa, for instance, must receive a constant supply from some quarter; it cannot come from the west, because it moves in that direction; it does not come regularly and uniformly from the east, and therefore must receive its supply from currents of air whose general tendency is from the north and south, as well as from the east.

When this body of air reaches the termination of its course on the eastern coast of America, it cannot perpetually accumulate; it does not continue to move in the same regular direction across the continent of America; it must therefore move off occasionally, if not uniformly, in other directions. Now, as it must be constantly fed with fresh supplies at its commencement, and as it must either take a new direction, or accumulate at its termination, in order to keep up the equilibrium, a part of it, at least, will find its way back, if there is no obstacle interposed; it cannot return directly, and therefore its course must be circuitous; and as it will meet with various impediments its motion will be irregular,

but still its general tendency will be to return to the quarter from whence its motion across the Atlantic originated. As to the general direction in which this *eddy current* moves, we can only state as a matter of certainty, that in the United States the most general course of the winds is from the westward. It seems probable, reasoning from analogy, that the portion of it that moves off toward the north, must, for a considerable distance, follow the course of the mountains that separate the waters which fall into the Pacific ocean from those that empty themselves into the bay of Mexico, thence gradually take an eastern direction, and finally tend towards the south. If this conjecture be right, southerly winds will be found to prevail from the bottom of the bay of Mexico along the eastern range of mountains that divides the rivers which fall into the Pacific ocean from those that empty themselves into that gulf; and these winds, after having taken an eastern direction in their course over the eastern side of North America and the Atlantic ocean, will, after they reach the coast of Europe, gradually take a southerly direction until they fall again into the course of the trade winds, from whence they will pursue the same round.

This supposition is much strengthened, when we reflect on the immense supply of air which must be necessary to feed these two currents that move uniformly and with considerable velocity across the Pacific and Atlantic oceans, occupying a breadth of about forty-six degrees of latitude, and embracing more than half the broadest circumference of the globe.

It may be objected that this body of air might be more naturally supposed to move in a westerly direction across the continent of America, and then the accumulation in the gulf of Mexico would feed the other great current that takes its course across the Pacific ocean. But to this it has already been answered, that we know it to be a fact, that the trade winds do not blow across the continent of America. No doubt there are irregularities in the movements of this current, and eddies that take different directions, and I do not pretend to carry my conjectures farther than as to the general course and tendency of the winds.

An argument as well as an illustration may be drawn from the direction of the currents of the ocean which are occasioned by the trade winds.

The gulf stream, which we have reason to believe is occasioned by the accumulation of the waters of the ocean in the gulf of Mexico, ranges along the coast of America, and taking gradually an eastern direction, may be distinctly traced as far, and sometimes farther, east than the banks of Newfoundland; and there can be little doubt that a part of the waters that form this current finally find their way again within the tropics, are again hurried on by the trade winds to the gulf of Mexico, and again go the same round.

The fact assumed in the position that I have been endeavouring to maintain, that the difference in climate between Europe and America is owing to the prevalence of the westerly winds, is, I believe, unquestionable, so far as it relates to the eastern coasts of the

continent of America and the western shores of Europe. Reasoning from analogy, I am led to conclude that the same winds prevail on the eastern side of the old, and the western part of the new continent. They who think these speculations worth perusing, and have a better opportunity than is afforded me of consulting books of voyages and travels, and journals of the weather in those regions, may probably ascertain with tolerable accuracy whether these conjectures are right.

I have fewer *data* in support of the conjecture, that this general tendency of the winds from west to east within the temperate zones, is occasioned by the trade winds from east to west within the tropics; yet perhaps its correctness may be more easily ascertained than that of the other. The numerous accounts of voyages that have been published, containing journals of the weather, in which the direction of the winds is noticed, when compared together, will furnish facts from which conclusions may be drawn with certainty.

It has long been ascertained that voyages are performed in less time from North America to Europe, than in the contrary direction; and though this is in part owing to the current of the gulf stream, it may also in part be ascribed to the prevalence of the westerly winds.

Do the winds generally blow in the same direction between China and the western coast of America? The many voyages that have of late years been performed by vessels engaged in the fur trade between these two countries, a number of which have been published, if

consulted would probably put this matter out of doubt. The same inquiry might be pursued with a greater prospect of certainty with regard to the general tendency of the winds in the southern hemisphere within the temperate zones.

What is their general course between the continent of South America and the Cape of Good Hope? From thence to New Holland, New Zealand, and to the western shores of South America? If it should be found to be from west to east, both these conjectures may be considered as established truths.*

To this theory may be opposed the fact which is commonly taken for granted, that the climate of Europe has become more temperate as the forests have been cleared, from which it is inferred that the same cause will produce the same effect in this country.

To prove that the European countries enjoy a climate now much more temperate than formerly, the testimonies of ancient writers are resorted to. A number may be found in Hume's Essay on the Populousness of Ancient Nations. Mr. Hume, who was himself of this opinion, having quoted them as collected by the Abbé du Bos, in support of it.

That there has been some change is very probable, but I think by no means so great a one as Mr. Hume and others of the same opinion have supposed. It is a

* It is not improbable, however, that the course of the winds within the southern hemisphere may be influenced in a considerable degree by the monsoons that blow across the Indian Ocean in opposite directions at different seasons.

very just remark of the Abbé du Bos, as quoted by Mr. Hume, that we should have more certainty with regard to this point if the ancients had known the use of thermometers; yet the temperature of a climate may be ascertained with tolerable accuracy by its vegetable productions. If trees or plants, incapable of withstanding hard frosts, are indigenous in a country, we may be sure that its climate is not a severe one.

The olive certainly will not stand the winter of any part of the United States, except on the sea coast of Georgia and South Carolina, and perhaps the banks of the Mississippi near our southern boundary; and even in France it is only to be found in a small district of the country lying open to the Mediterranean on the south, and sheltered by the mountains of the *Cevennes* on the north.

Now we have every reason to believe that it was known, and very extensively cultivated both in Greece and Italy, at a time long anterior to the commencement of regular history. In the fabulous account of the foundation of Athens the production of the horse is ascribed to Neptune, and that of the olive at the same time to Minerva, a certain proof that the olive was known in that part of Greece in the earliest ages, and before the period of regular tradition.

With respect to Italy, neither history nor tradition go back to so remote a period; but we find the olive frequently noticed in the Eneid, as being common in that country when Eneas is supposed to have arrived there. Had there been even a traditionary account of its

introduction at a later date, it is not probable that Virgil, who to a poetical genius of the first order added a great knowledge of natural history, would have mentioned it in his poem.

Had the winters of Italy been so severe as is inferred from a passage in Juvenal, quoted by Mr. Hume, we know that the olive could not have withstood them; this, and other such passages as may be selected from the Latin poets, must be considered as poetical exaggerations, and I am inclined to belive as many quotations might be made to prove the contrary. Virgil, in his beautiful description of Italy, says,

"Hic ver assiduum, atque alienis mensibus æstas.
"Bis gravidæ pecudes; bis pomis utilis arbos."*

However, it is not surprising that frequent mention of ice and snow should be made by the ancient classics. In those mountainous regions, while perpetual spring reigns in the valleys, the mountains are subject to all the severity of a northern winter; and at this day we are told that the use of ice is so general, that it is considered as one of the necessaries of life.

Still it is not improbable that the climate of various parts of Europe has become not only warmer in winter, but cooler in summer than formerly. By clearing the woods a more free passage is given to the winds, and if, as is supposed, they most commonly blow from the westward, they bring with them the milder temperature of the Atlantic ocean. There are several circumstan-

* Geor. lib. ii. 149.

ces which induce a belief that the summers in England have grown cooler than formerly; I will barely mention the well authenticated fact that vineyards once were not uncommon in a considerable district of that country.*

But it has been stated as an unquestionable fact, by several respectable writers, that the climate of the United States has already undergone a change, and is much more temperate than formerly; and as no other reason has occurred than the clearing of our forests, it is very naturally ascribed to that cause. The shorter duration of the snows, and the setting in of the winter at a later period, are urged as indubitable proofs that our climate has become more mild.

That snows do not lie so long on the ground as formerly, is, I believe, true; but this, instead of demonstrating that the winters are milder, only proves that they are more variable. The forests being cleared, the country is exposed to the winds from the land as well as the sea; the latter, if of any duration, commonly bring on a thaw, and it remains to be ascertained whether the former are not accompanied with a proportionate increase of cold.

The more tardy approach of winter, which seems equally well ascertained, would add so much to the length of our summers, were not the springs more backward than formerly; but it is generally agreed that in proportion as the autumns have grown warmer, the springs have become cool. This, I apprehend, instead

* See Miller's Gardener's Dictionary, Martyn's edition, art. VITIS.

of demonstrating that the general temperature of our climate has become more mild, rather leads to a contrary conclusion.

If the westerly winds are most prevalent in this country; and if, blowing over a heated surface in summer, and a frozen one in winter, they add to the inclemency of both seasons; will not the country, becoming more exposed to their influence as the forests are cleared, be subject to greater extremes of heat and cold?

It is true that by the same means free access is given to the more temperate winds from the sea, which render the climate more variable, and for the time more mild; but still as the land winds predominate, it would seem that the general effect ought to be an increase in the severity of both winter and summer.

That this has happened, or is likely to happen, in any great degree, I am not inclined to suppose; but rather believe that to a certain extent such an effect has been already produced.

The principal fact on which this opinion is founded is the increased backwardness of our springs, and the correspondent lateness of our autumns.

If heat were only produced *directly* by the rays of the sun, the summer solstice would not only be the season of greatest heat, but would divide the summer equally, and we should not have reason to expect a greater proportion of warm weather after that period than before; but every year's experience proves that on the twenty-second day of June, when the days begin to shorten, the summer is not nearly half over.

Although the rays of the sun become less and less direct, and the time of its continuance above the horizon becomes shorter, the temperature of the air does not correspond; but the heat continues equal, and frequently increases for a long time after this period.

The rays of the sun are as direct and the days are as long at the vernal as at the autumnal equinox; yet at the former season in this climate the frosts are never over, and at the latter they have never begun.

This no doubt is owing to reflected or accumulated heat: the earth being heated by the rays of the sun, not only retains its warmth for a considerable length of time, but communicates it to the atmosphere, and thus the summer's heat is continued for a much longer period than it would be, if it proceeded only from the direct rays of the sun.

Upon the same principle the increase of cold after the winter solstice, is accounted for. In the former case the heated surface of the earth communicates its warmth to the air, and in the latter being frozen, or at least relatively colder, it deprives the atmosphere of a part of its warmth.

It is owing to the same cause, that in the hottest days of summer the heat generally goes on increasing some time after the sun has passed the meridian, and in the winter nights the most intense cold is generally after midnight.

Now, as the surface of the sea is perpetually changing, and is never so much heated in summer or cooled in winter as that of the earth, it would seem to follow,

that on the main ocean both the summer and the winter, at the same time that they are more temperate, would set in earlier than in the same parallels of latitude on the land, and that the greatest heat of the summer days would not continue much beyond the time when the sun passes the meridian.

I may be mistaken in the fact, but believe nautical men of experience and observation will confirm it.

If the true cause has been assigned for the difference of climate between this country and Europe, and if this reasoning be correct, we ought to find that the seasons commence earlier in Europe than in the same latitudes in this country. Whether the fact be so, may be easily ascertained by those who have an opportunity of consulting and comparing a sufficient number of thermometrical observations in both countries; if it be, we may conclude that the increased lateness of our springs and autumns is rather a proof that our climate is growing less temperate than that it is becoming milder.

But another circumstance has been relied on in support of the opposite opinion, and as it has been verified by experiment, it only remains to inquire whether the inference deduced from it be just. The surface of the earth it is said becomes warmer as the forests are cleared and cultivation extended, and from thence it is inferred that the increased warmth of the earth produces a correspondent effect on the climate. Doctor Williams, the ingenious historian of Vermont, has published a set of experiments, by which it was ascertained that in summer the thermometer rose higher

when sunk in the earth of an open field, than when the same experiment was tried in a wood. Late in the autumn there was little or no difference, and in the winter no experiments appear to have been made.

The fact, it is presumed, cannot be questioned, and it might have been taken for granted without the experiment, as it only proves that bodies exposed to the summer's sun acquire a greater degree of heat than those that are in the shade; but the substance or body that affords the shade itself receives the heat, which, were it not interposed, would be communicated to the earth, and the *quantum* of heat remain the same, with this single difference, that it is communicated to one body instead of another.

It is said also, that as new countries are cleared and cultivated, the marshes are drained, and the surface of the earth is exposed to the drying influence of the sun and winds, and that the climate becoming more dry, of course, becomes more temperate. Admitting the fact, the conclusion by no means follows; fluid bodies as well as solid ones are susceptible of heat. It has been ascertained, that the climate of Europe is more moist than ours, as indeed we might expect; the winds there most commonly blowing from the sea, ours from the land: and yet the climate of Europe is certainly more temperate than ours. A country covered with morasses surely cannot be more moist than the sea itself; yet the seasons on the main ocean are more mild than on the land: it therefore does not follow that the air becomes temperate in proportion as it becomes more dry.

A circumstance is supposed to exist, with respect to the climate of the United States, that may be thought to bear upon the hypothesis I have been endeavouring to support. It has been asserted by writers, whose opinions are entitled to respect, and who no doubt made the assertion on what they thought good authority, that the climate of that part of the United States which lies west of the Allegany is much warmer than that of the country on the eastern side of those mountains; and Mr. Volney, in his View of the Climate and Soil of the United States, with his usual sagacity has endeavoured to account for it. He ascribes it to the trade winds, which, accumulating in the gulf of Mexico, and being stopped in their course, pass off laterally, and as he supposes, take a direction up the bason of the Mississippi. This hypothesis I believe to be correct in principle; but the fact to which it is applied, from the best information I can obtain, is by no means so certain. The first emigrants to the country of Kentucky, not content with describing the fertility of soil which it undoubtedly possesses, went further, and with that proneness to exaggeration which is natural to persons thus circumstanced, enlarged on the advantages of the climate, which they represented as much more mild than that of the district from which most of them had emigrated, and from whence they expected followers; but I do not understand that this opinion is at present generally entertained by the inhabitants of that country, and cannot learn that there are any facts which warrant it. The cold no doubt is greatest in the mountainous

regions that separate these two tracts of country, and the climate becomes more temperate as we descend from them, whether in a western or eastern direction.

It has been already observed, that the vegetable productions of a country are a good standard by which its temperature may be ascertained; there is one on which experiments are constantly making, in which, as they are directed by interest, there is little reason to suppose a want of care or accuracy. The cotton plant is an object of such importance, and the culture of it so generally practised and so well understood in those districts of the western country where it can be brought to maturity, that in travelling through that country from south to north, and finding it by degrees less and less general, and finally not attempted, and this without any material change in the soil, or the character and habits of the people, we may be certain we have passed the northern limits of the climate fitted for its growth. Now, unless I am greatly misinformed, it is cultivated to a considerable extent, at least for domestic use, as far, and indeed farther north on the eastern than on the western side of the Allegany.

Thermometrical observations would furnish the most conclusive evidence on the subject, but none have fallen within my observation, except those that have been published by Mr. Ellicott in his Journal (Appendix, page 1 to 12), and from them it appears that the cold during his stay at the confluence of the Mississippi and Ohio, in December 1796 and January 1797, was at least as intense as is usual at that season

on the eastern side of the mountains in the same latitude.

Another traveller, an intelligent and apparently an exact observer, Charlevoix, who passed down the Missisippi about the year 1720, gives an account of the cold he experienced in his passage from the Kaskaskias, in the month of November, which exceeds what is commonly felt at that season in the same parallel of latitude to the eastward.

Whether the climate of the northwestern part of the state of New-York, is, as Mr. Volney supposes, more mild than that of the New-England states, in the same latitude, I am unable to say; but supposing him not to be mistaken, is the cause which he assigns for this difference a true one? May not the neighbourhood of the *unfrozen* lakes render the northern and western winds, to a certain degree, more temperate; and may not the winds further eastward blow generally somewhat more from the north?

As to the prevalence of the southerly winds in the valley of the Ohio and the Missisippi, it yet remains to be ascertained, by a course of registered observations, whether it is greater in that part of the United States, than on the eastern side of the Allegany.

Mr. Volney's conjecture, that the trade-winds ascend the Missisippi, corresponds with the theory which I have endeavoured to demonstrate; but in the application of it to facts, he seems not to have reflected sufficiently. The supposition that they are diverted from their course by the mountains of Darien, at a

great distance, not less than eight degrees of longitude to the east of that isthmus, seems not probable; and the face of the country through which the Missisippi flows is such, that it cannot be said to form a bason or valley of any considerable extent. Indeed at its entrance into the gulf of Mexico, the river rather presents an obstacle, than a passage for such a current of air; the *Delta*, which no doubt is the gift of the Missisippi, projecting many miles into the gulf, and the river itself meandering through the vast and level plains of Louisiana, unattended by parallel ranges of mountains, or any inequalities in the surface of the country, that should give the winds that particular direction. In fact, the whole extent of the coast between Cape Florida and Mexico is one level plain, very little elevated above the sea, and opposes no barrier to the passage of the winds, which being checked in their course by the isthmus of Darien, most probably do take a direction to the north; but for the reasons already assigned, I should think much further to the west than Mr. Volney supposes.

No doubt local circumstances may have an effect on the climate of particular districts, and perhaps of whole countries, in different ways, which are not referable to the cause I have assigned; the monsoons, for instance, which blow regularly across the Indian ocean in opposite directions at different seasons of the year, probably influence the course of the winds for a considerable extent beyond their limits: but in what manner, and with what effect on the climate of New-Holland to the

south, or the shores of Asia and Africa on the north, the means of information I possess do not enable me to say; and, with respect to the subject of the present inquiry, it is useless to conjecture: it may be proper, however, to notice more particularly the winds that prevail in summer on the coasts of the United States, more especially the southern parts, and which are said to extend further up the country with the progress of cultivation.

These winds, blowing from the ocean, and generally setting in after the meridian of a hot day, and ceasing in the course of the evening, have all the characters of what is called the sea-breeze in the tropical climates, and it may be presumed are owing to the same cause, the heat and consequent rarefaction of the air on the coasts; which, according to the laws of gravity, occasions a motion of the cooler and more dense air of the neighbouring sea to fill the vacuum.

That these winds temper the heat of summer on the coast; and that in proportion as they extend further up the country they produce the same effect on a larger scale, seems unquestionable; and so far the climate of that portion of the country to which they now extend, and which has been brought within their influence by clearing the forests, may have been in some degree rendered more temperate in summer. The effect, however, corresponds with its cause, which operates within narrow limits and short periods of time. The general course of the winds, and the general temperature of the climate, are but little affected by the one or the other.

Before we drop this inquiry, other circumstances may require some consideration. While the climate of the United States and the British colonies in North America is subject to greater extremes of heat as well as cold than the countries of Europe in the same latitudes, cold is more generally prevalent in America, and the medium temperature of the weather is lower than under the same parallel in Europe. The general temperature at Quebec, for instance, is lower than at Paris, which is more than two degrees further north, though probably there are some days in summer much warmer at the former place than at the latter.

Whether this difference does not lessen as we advance farther south I am not so certain, but rather believe it does, and that very considerably. It may be asked how this prevalence of cold on the eastern coast of America is accounted for, on the hypothesis I have been endeavouring to prove.

Admitting the fact, and that no sufficient reason can be assigned for it, it does not necessarily contradict the opinion I have advanced, that the cause of our climate being subject to greater extremes of heat and cold than that of Europe, is the prevalence of the westerly winds in both. Two countries may, in the *medium* temperature of their climate, exactly agree with each other, and yet the extremes of heat and cold in each be widely dissimilar; one may enjoy an exemption equally from intense heat and cold, and the other be subjected to both in the greatest degree. So, in the same country, the *medium temperature* of the climate may proceed

from one cause; the extremes to which that country is subject, to another.

There is, however, a remarkable coincidence in the climate of the northern part of the eastern sides of both continents, not only as they are alike subject to great extremes of heat and cold, but with respect to the greater prevalence of cold, when compared with that of Europe and probably the western coast of America.

This coincidence, I think, most probably proceeds from a cause operating alike on both, and perhaps the same that occasions the extremes of heat and cold to be greater on the eastern than on the western sides of both continents.

If, as I have supposed, the trade-winds (or at least a portion of them), after their course to the west is obstructed by the continents of Asia and America, take a circuitous course, first northwardly, then gradually to the east and south, till they reach the points of departure on the western coasts of America and Asia; may not that part of the current which makes a wider circuit, passing furthest to the north, take rather a southern direction before it leaves the continent? If such should be the fact, the northeastern parts of both continents would not only be subjected to greater extremes of heat and cold by the winds blowing from the westward, but in proportion as these winds should come from a region to the north of west, they would bring with them an increase of cold from that climate. If, therefore, from this cause, or from any other, it shall be found that the northwesterly winds are more pre-

valent on the northeastern coasts of both continents, than on their western shores, this circumstance alone would be sufficient to account for the greater prevalence of cold in those regions. This conjecture appears more probable than any other that has occurred to me; whether the fact on which it rests really exists, remains to be ascertained.

Having endeavoured to prove that the severity of our climate and that of the eastern shores of Asia is owing to the prevalence of the westerly winds, and that the same cause produces an opposite effect on the western coasts of both continents; and having attempted to account for it by the currents of air which constantly move across the Atlantic and Pacific oceans, from east to west within the tropics; I should here conclude this essay, were I not desirous that these speculations might be the means of inducing persons of better information and more leisure to pursue the inquiry, and were I not persuaded, that conclusions might be drawn from these positions which would lead to useful results.

Whether the physical or intellectual powers of the human race are affected by climate, has frequently been the subject of discussion among those who have directed their attention to questions of this nature; and whether our climate, being liable to greater extremes of heat and cold than that of Europe, operates favourably or otherwise on our faculties, are questions with which I do not pretend to be conversant, and which to any practical purpose it seems unnecessary to discuss.

The United States, lying within the temperate zone, their climate, subject as it is to great variations, must on the whole be classed among the temperate; and men of great endowments, both mental and corporeal, have been born and reared in countries that are subject to greater cold, and in others where the heat is more intense.

What effect our climate has on animals, as compared with that of Europe; and how far our modes and arts of life, especially the most generally practised and most important of all arts, that of husbandry, are influenced by climate, how far by habit; which of these, brought by our ancestors from Europe and still followed by their posterity, ought to be abandoned as not suited to the vicissitudes of our seasons; and what benefits would accrue from adopting others at present unknown or little practised among us; are topics of no little moment, and which hitherto have not been much attended to. Practical men seldom apply their thoughts to such subjects, and more seldom communicate them to the public; and it has happened, rather unfortunately perhaps, that some eminent European writers, having erroneously taken it for granted that our climate was not only colder but more moist than that of Europe, and having drawn conclusions from that supposed fact unfavourable to this country, some of our most distinguished citizens, eager to detect error and zealous for the honour of their country, not content with refuting these positions, have gone into the opposite extreme, and have contended that our climate

was equally temperate with that of Europe in the same latitudes; or if not so now, that it would gradually approach the same standard, as our forests should be cleared and cultivation extended over the face of the country. Had it been admitted that our climate was less temperate, and the difference been traced to a permanent cause; instead of controverting an unquestionable fact, or looking for changes which are never to happen, I cannot but believe that many new improvements would have been struck out, and that various important branches of agriculture would have been established among us, that are at present unknown; of these perhaps the most important is the culture of the vine. Could we substitute for our beverage the pure and wholesome juice of the grape, instead of the liquid poisons obtained by distillation, so fatal to the health and morals of the laborious part of the community, what a change would be effected in the face our country? How many industrious families would be saved from ruin! The habit of drinking fermented liquors has prevailed from the earliest ages among the race of men from which we are descended; and though the abuse of them, like that of every other good, no doubt has been productive of evil, it can hardly be questioned that they have added more to the stock of human enjoyment than they have taken from it. The use of ardent spirits, which was unknown among the ancients, has produced fewer benefits and incalculably greater mischiefs. Drunkenness is a much more prevalent vice, and is much more fatal

among those who are addicted to the use of distilled liquors, than those accustomed to the use of wine or beer.

No one, at all acquainted with human nature, will ever expect that the people of this country, any more than the present inhabitants of Europe, will ever abandon the use of intoxicating drinks; and ardent spirits will be in general use among the mass of the community until a substitute is found. That wine would in a great measure supplant them, need not be doubted, if it could be produced in our country (for it is idle to expect it from abroad) in sufficient plenty for general use.

It is much to be regretted that the efforts made at different periods, and in various parts of the country to attain this object, have hitherto been so unsuccessful as to induce a very general belief that there is something in our soil or climate so unfriendly to the vine, that it can never be cultivated here with success. As to the former, we know that the finest wines of Europe are the produce of soils of various descriptions, extremely different from each other, and it cannot be doubted that we have the same varieties here. The difficulty, if there be one, independent of our want of experience, must I think be referred to climate. Possibly it is insurmountable in some parts of the country; but I am persuaded that there are large districts within the United States, in which the grape would find as genial a climate as in Europe. The want of success that has hitherto been experienced, I

think may have happened by the selection of kinds not suited to our climate. The vine, as well as other fruits which have been long cultivated, runs into innumerable varieties; and every wine country in Europe has those which have been found suited to its climate, or in a succession of ages have become accommodated to it. In selecting varieties, two leading circumstances would seem to require attention: the first, that they should be able to stand the severity of our winter; and the second, that the grape should ripen at that season of the year best suited to the making of wine. If the vintage take place during the summer heats, the wine must become acid by excessive fermentation; and on the other hand, a grape that does not attain its maturity some time before the usual period of the setting in of the frost, might often be overtaken by the winter, and a year's labour lost. Indeed, if in a climate more temperate than our own we should find a grape that united these two requisites, it might still fail, when removed to a climate different in other respects from its own. Various kinds of wheat from the Mediterranean have been occasionally sown in this country; and though they resist the cold of our winter, and ripen at the same time with the ordinary kinds, they have very generally, if not always, yielded an imperfect grain. We ought, therefore, in choosing varieties of grapes, to look for them in those countries whose climate most nearly approaches that of the district where the experiment is intended to be made. In Italy, Spain, and Portugal, and perhaps the south of France, we should

doubtless find grapes of different kinds that would not ripen too early in the season; but being none of them accustomed to the severity of a winter like ours, it is highly probable that from this cause, most if not all of them would fail here. The vines of Burgundy and Champagne cannot be expected to succeed, both on account of the severity of our winters, and because the grapes would ripen too early in the autumn;* and yet perhaps all the varieties of grapes on which experiments have been made, have come from these countries. If we ever succeed, I think it must be by bringing our vines from the interior of Germany, from Hungary, or perhaps from Switzerland, countries remote from the sea, and whose climate is not much unlike that of many parts of our own.

It is a known fact, that as we advance from the seacoast into the interior of the continent of Europe, from east to west, the winters grow colder and the summers warmer; and in consequence of this difference of climate, the vine is found to succeed in the more eastern and less temperate regions, much further to the north than on the seacoast. The neighbourhood of *Nantz*, for instance, a little to the north of latitude 47 , is the northern limit of the wine district of France, on the western coast; but as we go to the eastward, the cultivation of the vine extends further and further to the

* See Legaux's Table of Vegetation in Pennsylvania, compared with that of some of the most famous wine countries in Europe. M'Mahon's Gardener's Calendar, p. 480, extracted I believe from some periodical work.

north, and on the banks of the Rhine excellent wines are produced, at least three degrees further north, and where the severity of the winter is much greater.*

In Germany the line extends still further north, into Saxony; and in Hungary the vintage of Tokay, the richest perhaps in the world, is gathered considerably to the north of latitude 48°. Were our vines brought from these countries to those parts of the United States most like them in climate, it seems highly probable that many of them would succeed.†

With regard to the degrees of heat, a pretty accurate judgment might be formed by a comparison of thermometrical observations that have been made in both countries; and the period when the grapes would attain maturity here might be calculated from the periods of harvest, and the fall of the leaf from deciduous trees that are common to both countries. If in any two districts, the one in Europe, the other in America, the wheat harvest is at the same season of the year, the fall of the leaf at the same period, and the extremes of cold and heat are nearly alike, it can be hardly doubted, that if wine is made in one of those countries, it might be produced from the same grape in the other.

These rules are capable of very extensive applica-

* See Young's Travels in France, and his map of the climate of France, annexed to that work.

† Since the above was prepared for the press, I have seen in the National Intelligencer an account of some attempts to cultivate Hungarian vines in Maryland, near Hager's Town, which are said to have succeeded.

tion; and if they are correct, we might, without wasting years in uncertain experiments, calculate in the first instance, with a great degree of accuracy, whether any particular grape would be suited to our climate or not. Perhaps in the more southern parts of the United States it would be difficult to apply them, as it may happen that in all the wine countries of Europe whose winters are equally severe, the harvest is gathered at a later period, and the autumn comes on sooner. Such, I am inclined to believe, is the case; indeed I am persuaded that the great warmth of our summers is much more unfavourable to the cultivation of the vine than the winter's cold; and of course that some of the more northerly districts are much more suited to it than those furthest south. Wine, I believe, is never made within the tropics. In Europe Indian corn is found to require a warmer climate than the vine,* and there are few, if any districts in this country, where some of the varieties of that grain will not come to perfection. Most probably the winter of a large portion of the eastern states would be found too severe for most kinds of the vine. Were I, upon conjecture, to fix upon a spot for an experiment, I should look for it in those parts of the United States least subject to the extremes of heat as well as cold. The country south of the lakes

* Young's map of the climate of France, in which the northern limit of the climate fit for the cultivation of maize is placed about two degrees further south than that of vines; both of them extending from the coast to the interior in a northeasterly direction.

Erie and Ontario, and the mountainous district that separates the eastern waters from those that fall into the Missisippi, in Pennsylvania, Maryland, Virginia, and perhaps the Carolinas, probably would be found to offer the most favourable situations for this purpose; but this can be determined by experience alone. Perhaps the experiment has already been made, under the circumstances I have ventured to recommend, and without success; but I cannot learn that it has ever been done: and if, in the first instance it should fail, it ought not to be given up as hopeless, until a great number of trials are made with different kinds of vines, such as are most esteemed in the countries from which they are brought, and are most likely to suit our climate.*

It may be supposed that the improvement of our native grape would be a shorter and more certain process; but all the kinds I have met with have such harsh and crude juices, that I apprehend they cannot be improved, so as to become equal to the cultivated grape, for ages. The wild crab-apple is understood to be the original stock of all the fine varieties of that fruit of which we are now in possession. Cultivation no doubt has done much in the course of thousands of years, but most probably the greatest improvement has been effected by repeated selections of the best accidental varieties from seed, until they have been

* Nullum genus vitium conserendum est nisi fama nullum diutius conservandum nisi experimento probatum. Columella, l. xvi. iii. Sec. 2.

brought to their present improved state. In as long a course of time, possibly sooner, the native grape might be brought to the same state of perfection; but as all our cultivated apples are from European stocks, and no improvement of the native crab has hitherto been effected, it seems reasonable to expect that if we look for equal success with the vine, we must pursue the same course.

Among other objects of cultivation that might be introduced or extended among us, we may perhaps reckon rice. This most valuable grain, which yields a greater supply of food from a given extent of ground than any other, is found, like Indian corn, to require a greater degree and longer duration of heat than is afforded by the climate of the more northern parts of Europe; and, unlike that plant, it does not run freely into varieties, or readily accommodate itself to short summers. On the sunken grounds of the Chesapeak and its tributary streams, and perhaps the Delaware, are large tracts, that in soil and situation are well fitted to the cultivation of this plant. That the heat of summer is sufficiently great, there can be no question; the only doubt is, whether its duration is long enough. The kind that is cultivated in Carolina is found not to ripen sufficiently early; it is, however, far from improbable, that in other parts of the globe varieties of this grain might be found that would attain maturity sooner. Rice is said to be cultivated extensively on the banks of the Po, at no great distance from its source: a climate, the medium temperature of which I should think

not materially different from that of the lower country of Virginia and Maryland. It is also said to have been lately introduced into Hungary,* the climate of which probably approaches still nearer to that of those parts of the United States. Whether it is cultivated so far to the north in China, I have not learnt: if it be, it can hardly be doubted that it would succeed equally well in the same parallels of latitude in the maritime parts of the United States.

The similarity of climate between the United States and those parts of China that are in the same latitudes, has long since been remarked; and there is certainly no part of Europe whose climate so nearly resembles our own. Unfortunately our intercourse with that country is limited to a single port, and that further south than any part of the United States. If a free communication is ever established between our country and the more northern districts of China, it may probably be the means of introducing among us many plants of great utility, and which, being transplanted from a climate so like our own, would at once become naturalized to it.

On the other hand, a due attention to the effect of our climate on some plants brought from Europe, might perhaps induce us to abandon the cultivation of them in the more southern districts of the United States. The common oat is a grain little suited to a warm climate, accordingly it is hardly known as an object of

* Miller's Gardener's Dictionary, Martin's edit. art. Oryza.

husbandry in the more southern countries of Europe. In America, while the northern states and the mountainous districts of the south yield a grain that well repays the labour of the husbandman, that which is produced in the flat country of the southern states, as has been remarked by an intelligent English traveller,* is so light that it hardly seems to possess the principle of vegetation: yet still, for the want of a proper substitute, it is cultivated throughout that range of country, whether to advantage or not, is at least doubtful.

These instances are put by way of example. An examination of this subject in detail, would be foreign from the object of this inquiry; but I hope these unconnected hints may induce persons of more ability and better means of information, to go more largely into it.

Agriculture, like other arts, must depend for its advancement on experiments; but when these experiments are conducted on just principles and in conformity to a correct theory, the road to improvement may be much shortened, and the labour and expense of attempts that cannot be expected to succeed, will frequently be avoided.

By a due attention to the rules I have mentioned, and others that will readily occur to a reflecting mind, I am persuaded there is hardly a tree or a plant which belongs to any part of the old continent within the temperate zones, that might not be naturalized in some

* Mr. Strickland's communications to the board of agriculture.

part of the United States, and that without the waste of time or labour in a succession of fruitless experiments.

It may be thought, that as our climate is subject to greater extremes than that of Europe, the country is not capable of producing some plants that flourish there. This no doubt is true, as to a large portion of the United States, with respect to some trees and perennial plants; but those vegetables that are useful to man are, the greater part of them, annual, and for their production I am inclined to think our climate has the advantage of the more temperate one of Europe. Indian corn, a grain second in utility only to wheat, if it be second, requires a degree of warmth that in Europe is only found in the more southern regions. In every part of the United States, from north to south, it is cultivated with success.

Cotton, a plant of such extensive use, which flourishes to so great a degree throughout nearly or quite one half the extent of our country, is only known as an object of cultivation in some small districts in the southern parts of Europe.

The near resemblance between the climate of the United States and China has been already mentioned: perhaps no two countries on the face of the globe are more alike in this respect. That climate certainly cannot be thought a bad one, which of all others has been found most favourable to human life, and the richest in vegetable productions.