Bioclimatic Comfort Evaluation for Vladivostok and it's Islands Territories

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The efficiency of architectural correction of climatic conditions by buildings, greening and etc. first of all is determined by results of their interaction with a wind and solar radiation. The change of wind and insolating mode of open spaces by architectural and landscape design forms correct other meteorological dates in their borders, such as: temperature and damp conditions, the mode of rainfalls and snow, and also directly influences the comfort conditions of adjoining closed spaces.

For the Russian Far East mountain territory occupying more then 80% of region, the significant variability of background climatic conditions on the limited sites is characteristic. According to Far Eastern Scientific Institute of Building meteorological explore of Vladivostok territory basic northern monsoon speed 7-9 m/s change from 1-2 to 12 m/s for different landscape forms. The gradient of air temperature between south and north oriented slope can investigate 10 – 12 degrees from 5-6^0 C above to 5-6^0 C degrees below zero as a result of low angle sun and strongly north wind at the end of October. The famous researcher of Russian Far East territory L. Shrenk note in 1899 in his book that natives usually build winter and summer villages according to the landscape forms windbreak possibility season changes for north and south wind directions, and season changes of sun exposure of sites.

As a result of interaction of vector climatic factors and spreading surface, the intensity of solar radiation, speed and direction of a wind are differ from initial climatic dates. Therefore the possibility of winter solar warming and summer aeration's of spaces for improvement of a microclimate of living and public spaces are essentially corrected, or necessity of protection from cold winter winds and summer over warming are eliminate. In each case necessary architectural means of transformation of conditions of an environment are various. The dependence of architectural and planning decisions on vector climatic factors and their microclimatic variability in mountain areas allows, having considered these factors in the territorial attitude to determine borders of applicability of different town-planning decisions. Bioclimatic comfort evaluation of territory as well as borders of different architectural and town planning measures put into practice will be achieved as a result of method employment.

To create comfortable conditions in temperate climate under winter and cold summer wind flow over 5 m/s residential area needs in large spectrum of windbreak measures of pedestrian streets and courtyards, which are different for winter and summer wind also. At the same climate conditions residential area needs in aeration of its territory in hot July and August and no windbreak measures if the wind speed is from 1 to 4 m/s per year. Evaluation of northern and south-eastern monsoon wind course per year according to two level wind speed scale give us four types of territory with four types of bioclimatic comfort levels as with the four different types of windbreak and aeration measures combinations. Take into account summer heliothermic direction and low angled winter sun relief division on sun exposure and shading slopes the final bioclimatic comfort division of territory includes twelve wind-solar bioclimatic types.

Wind speed and sun exposure influence on heat exchange with surroundings determinate the humans sensation of heat comfort in different weather conditions. Sun shine windless site suitable for walking even in cold frosty days while shading and blowing site does not even if air temperature is the same. Make up the scale of 12 relief site according to decrease of possible discomfort wind and sun combinations per year received the scale of heat comfort evaluation for low higher cliff hills landscape characteristics for Vladivostok and its suburbs (Drawing 1).

For example mostly discomfort conditions are notable for shading from low angled winter sun slopes blow up by cold winter and summer wind upper 5 m/s (1 – hard discomfort), drawing 1. Closed from summer cold, humid and foggy south-east monsoon only – summer wind speed is from 1 to 4

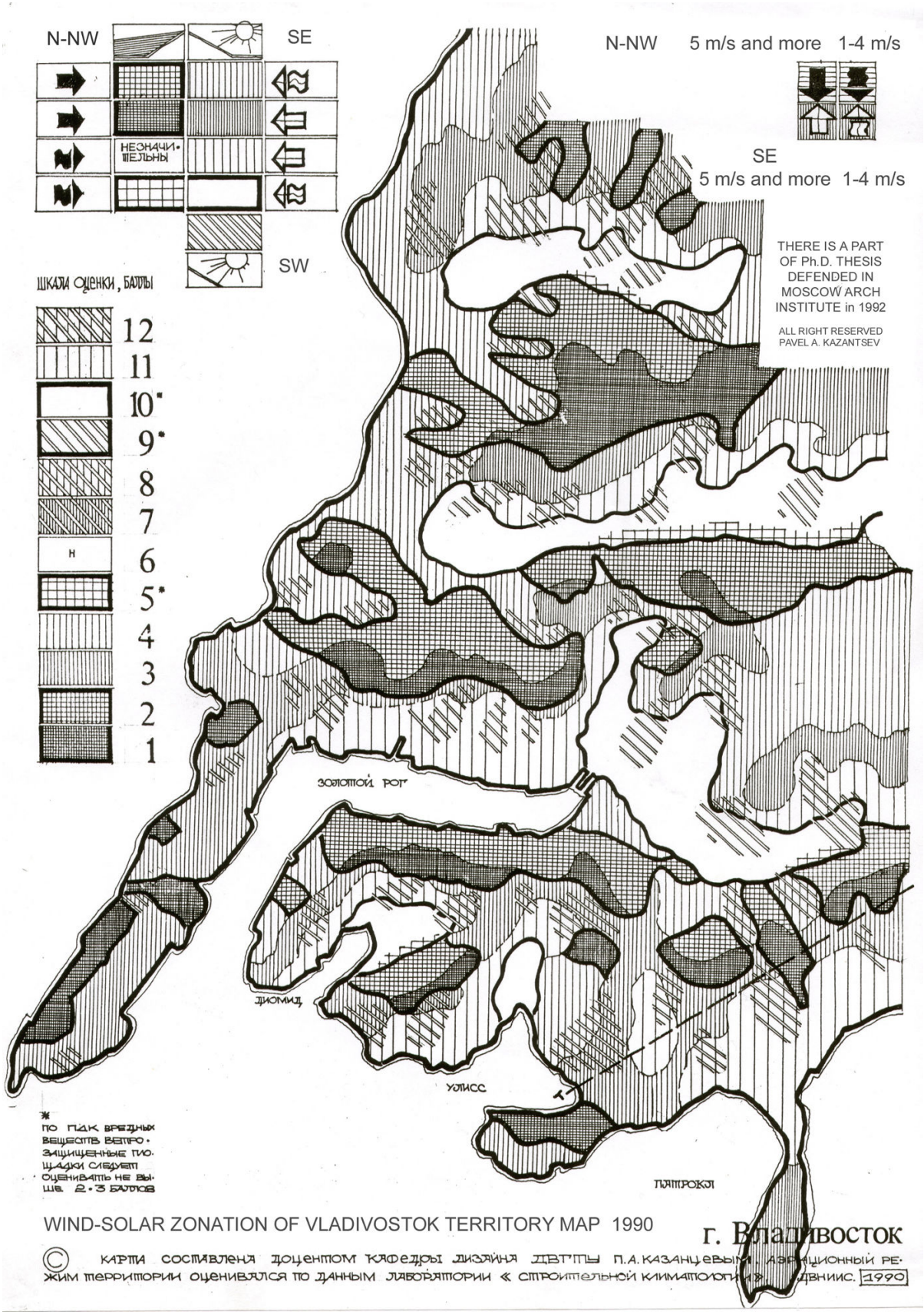
m/s – such site become a more comfortable during first stage of summer monsoon development keeping all discomfort conditions in winter (2). If the first type of site do not change its wind conditions but has a direct sun shine during winter solstice its bioclimatic comfort evaluate as third level type (3). Accordingly has a direct sun shine during winter solstice site with strong winter wind but closed from summer south-east monsoon belong to four level type (4), and so on. Summer heliothermic direction oriented slopes without strong wind per year will be mostly comfortable but need in sun shading in July and August (12).

<table>
<tr><td rowspan="3">WINTER MONSOON WIND</td><td colspan="2">SUN EXPOSURE</td><td rowspan="2">SW July-August heliothermic direction open site (K)</td><td rowspan="3">SUMMER MONSOON WIND</td></tr>
<tr><td colspan="2">low angled winter sun</td></tr>
<tr><td>shading site (E)</td><td>sunlit site (F)</td></tr>
<tr><td rowspan="2">N-NW
5 m/s and more per year (A) – open to wind site</td><td>ADE (1)</td><td>ADF</td><td>ADFK</td><td>SE
from 1 to 4 m/s per year (D)</td></tr>
<tr><td>ACE</td><td>ACF</td><td>ACFK</td><td rowspan="2">SE
5 m/s and more per year (C) - open to wind site</td></tr>
<tr><td rowspan="2">N-NW
from 1 to 4 m/s per year (B) - closed site</td><td>BCE</td><td>BCF</td><td>BCFK</td></tr>
<tr><td>BDE</td><td>BDF</td><td>BDFK (12)</td><td>SE
from 1 to 4 m/s per year (D)</td></tr>
</table>

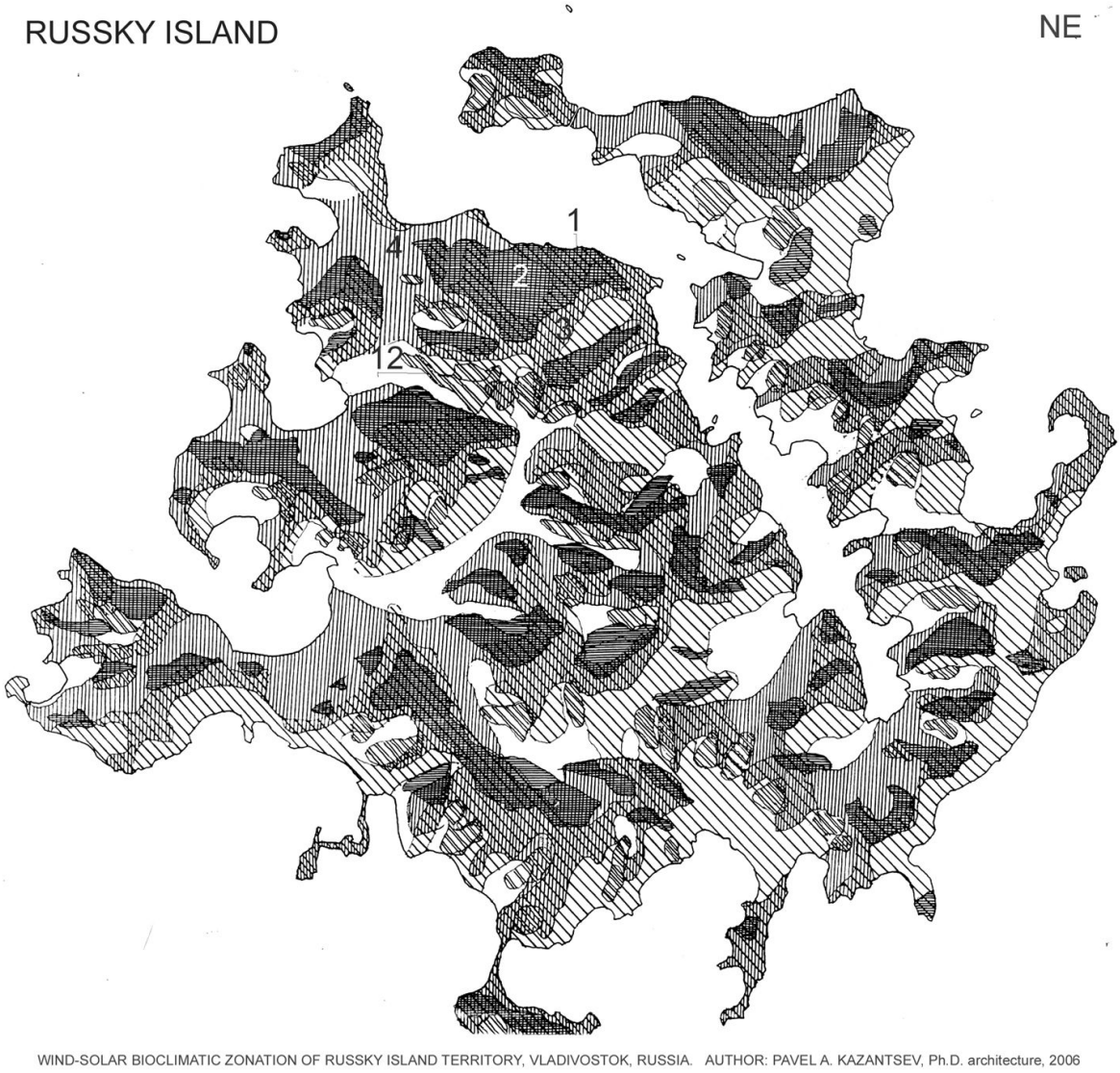
Typical landscapes for Vladivostok territory and its suburbs are low higher from 50 to 150 - 200 meters cliff hills crossing by mostly East-West oriented valleys and sea bays. Air temperature in January is about 12-15^0 C below zero. In April and a few ten - fifteen cloudy and foggy days in June air temperature is 8 -14^0 C above zero, and 22 – 25^0 C degrees above zero in August in combination with 100% relative humidity.

Wind may be differing to 45^0 – 90^0 from basic N-NW and SE direction flow between hills. Shading site may be a valley under the hills not only north oriented slopes. Open worked windbreak as different materials walls with 30-40% of openings is more preferable to correct SE strong wind especially in April there is no foliage and in August when low speed SE wind is propitious at the same site. Special design windbreak buildings more than H/8H proportion with wind oriented buffer spaces different “horseshoe” forms is more preferable to correct winter N-NE wind of course. We will use passive and active solar house design for (**F**) type site while for (**E**) type site we need in passive house design first of all. But if we chose wind shelter forming by hills comfort type site after preliminary bioclimatic evaluation of territory there is no shelter techniques need in town planning and design of course.

Do not publishing anywhere out of the Russian border* before this method used for detail maps of bioclimatic comfort zones division work out in 90th for Vladivostok, Nakhodka and Suchan cities territory, Sedanka recreation park master plan development and, in collaboration with Ph.D. candidate Nikholy V. Kasianov, previously Russky island territory zonation. Detail bioclimatic comfort map work out by author in 2006 for all Vladivostok’s island territory of Peter the Great gulf, such as about hundred square km. Russky island (new redaction, drawing 2), Popov and Reynike islands and peninsula Peschany, as part of city development master plan for future 2012 Asian-Pacific Economy Forum and south Primorye cities agglomeration needs.



Drawing 1. Vladivostok city wind-solar zonation map work out in 1990



Drawing 2. Russky island wind-solar zonation map work out in 2006

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