



BIOGEOCLIMATIC FRAMEWORK FOR CBVM PROJECT

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Madrid, Spain



CBVM
Circum Boreal Vegetation Mapping



Uppsala, April 1st-3rd 2009



MAIN TOPICS TO BE DISCUSSED

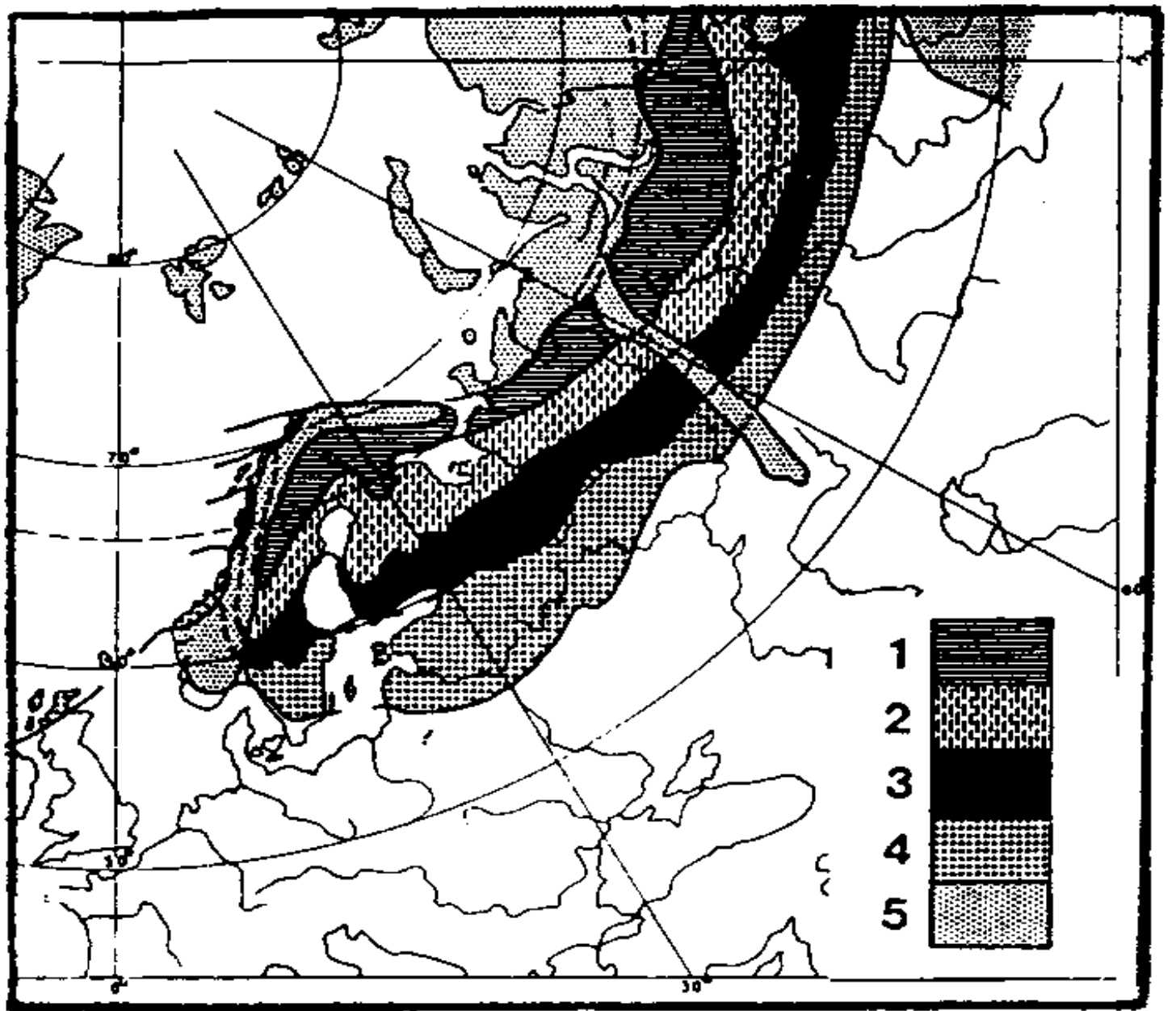
- BioGeoclimatic framework - the need of a **worldwide consensus**
- The *Boreal* macrobioclimate in the northern and southern hemisphere
- Polar* and *Boreal* macrobioclimate areas: the *arctoboreal* territory in the northern hemisphere
- Boreal* bioclimatic delimitation and coverage





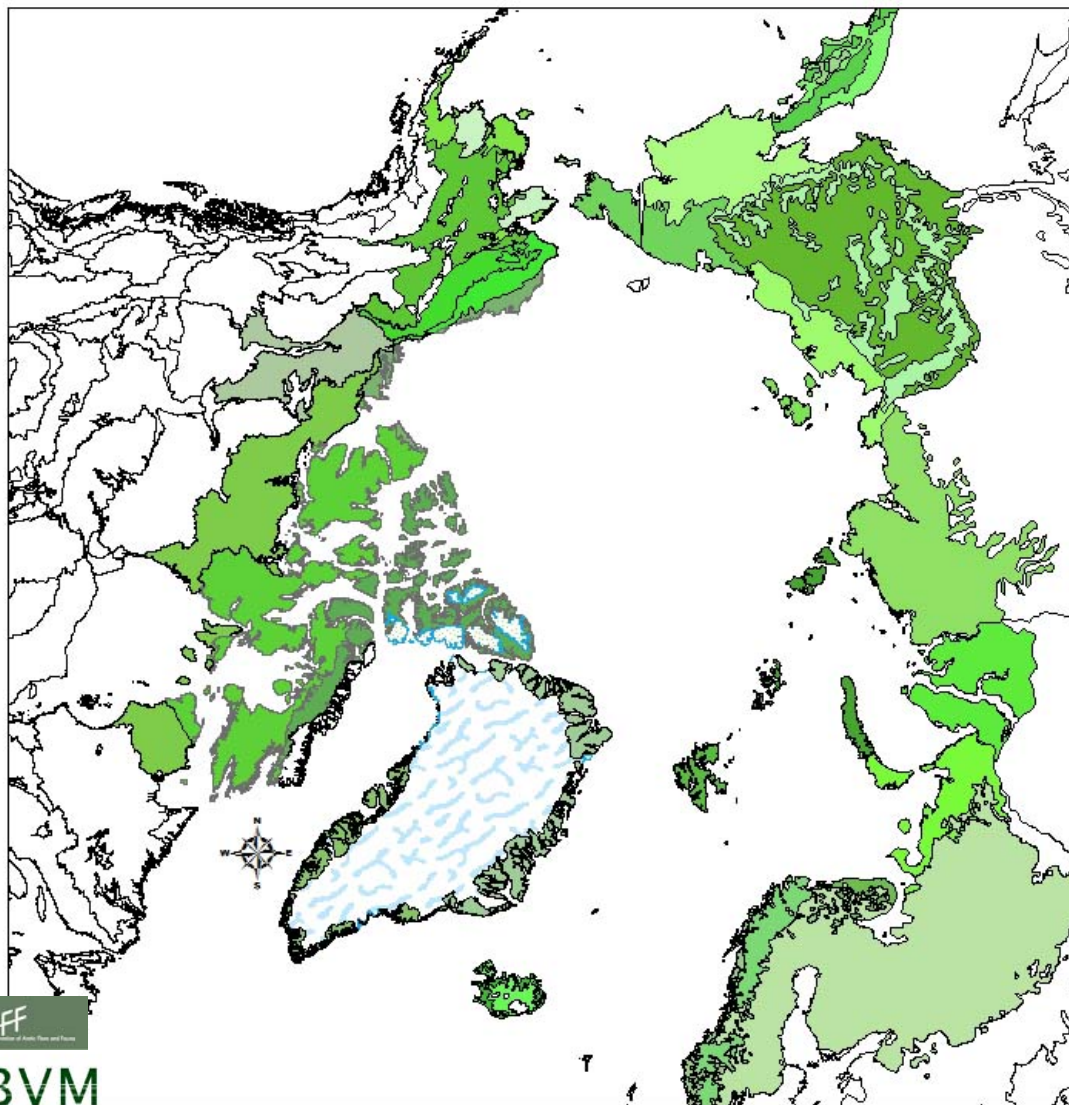
Circumboreal
Zone

Hämet-Ahti,
1981





WWF Terrestrial Ecoregions



- Other Ecoregions
- Arctic Ecoregions**
 - Aleutian Islands Tundra
 - Arctic Coastal Tundra
 - Arctic Foothills Tundra
 - Arctic Desert
 - Bering Tundra
 - Beringia Lowland Tundra
 - Beringia Upland Tundra
 - Brooks/British Range Tundra
 - Cherskii/Kolyma Mountain Tundra
 - Chukchi Peninsula Tundra
 - Glacier
 - High Arctic Tundra
 - Iceland Alpine Tundra
 - Iceland Boreal Birch Forests
 - Interior Alaska/Yukon Lowland Taiga
 - Kalaallit Nunaat high Arctic Tundra
 - Kalaallit Nunaat Low Arctic Tundra
 - Kamchatka Mountain Tundra and Forest Tundra
 - Kamchatka/Kurile Meadows and Sparse Forests
 - Kamchatka/Kurile Taiga
 - Kola Peninsula Tundra
 - Low Arctic Tundra
 - Middle Arctic Tundra
 - Northeast Siberian Coastal Tundra
 - Northeast Siberian Dispersed Taiga
 - Northwest Russian/Novaya Zemlya tundra
 - Northwest Territories Taiga
 - Novosibirsk Islands Arctic Desert
 - Scandinavian and Russian Taiga
 - Scandinavian Coastal Coniferous Forests
 - Scandinavian Montane Tundra and Taiga
 - Snow, Ice, Glaciers, and Rock
 - Svalbard Arctic Tundra
 - Taimyr/Central Siberian Tundra
 - Yamalagydanskaja Tundra



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Computerized Bioclimatic Maps

Bioclimates of the Arctoboreal

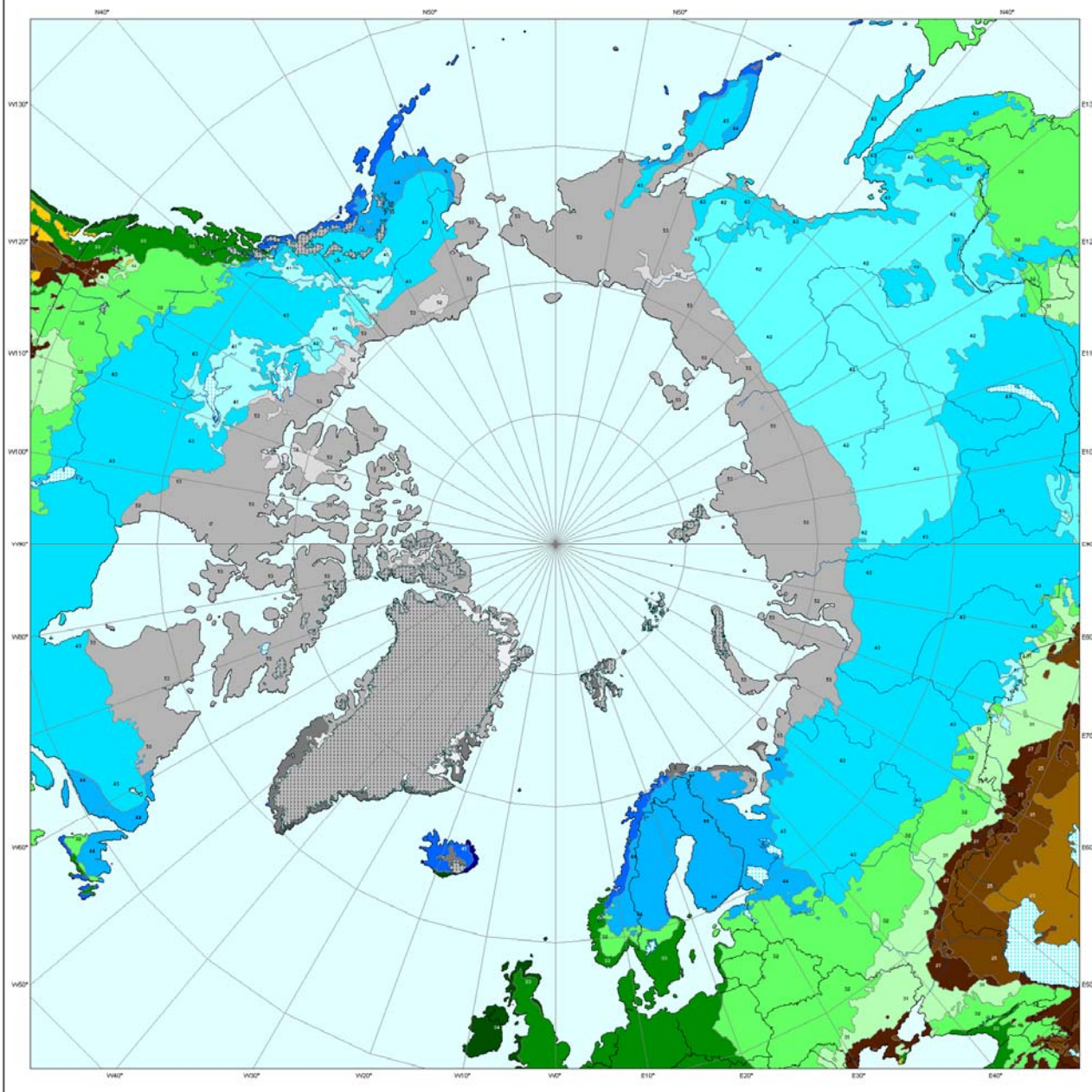
©2008 - X. S. Rivas-Martínez, S. Rivas-Saenz & D. Sánchez-Mata

Polar Stereographic Projection from:
 Bioclimates of Asia, with M. Luisa Fernández,
 Y. Nakamura & P. Krestov
 Bioclimates of Europe & Mid-East, with T. E.
 Diaz & A. Pinar
 Bioclimates of North America, with Manuel
 Costa

Elevation: USGS Hydro3x DEM
 ESDU Arc Atlas - Atmosphere, 1995
 GlobalBioclimatics - Atmosphere, 2000
 GlobalBioclimatics - GbcApi & GbcGis, 2008
 Scale: 1 pixel = 5 Km² 500 Km

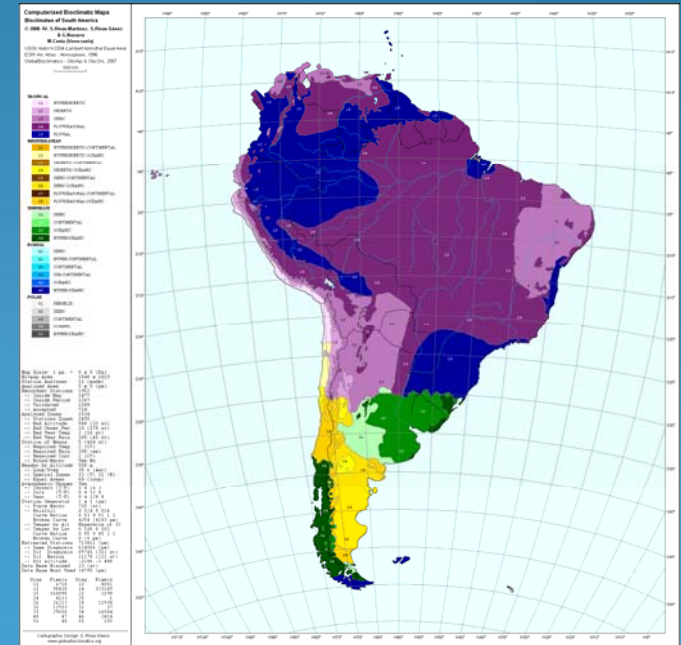
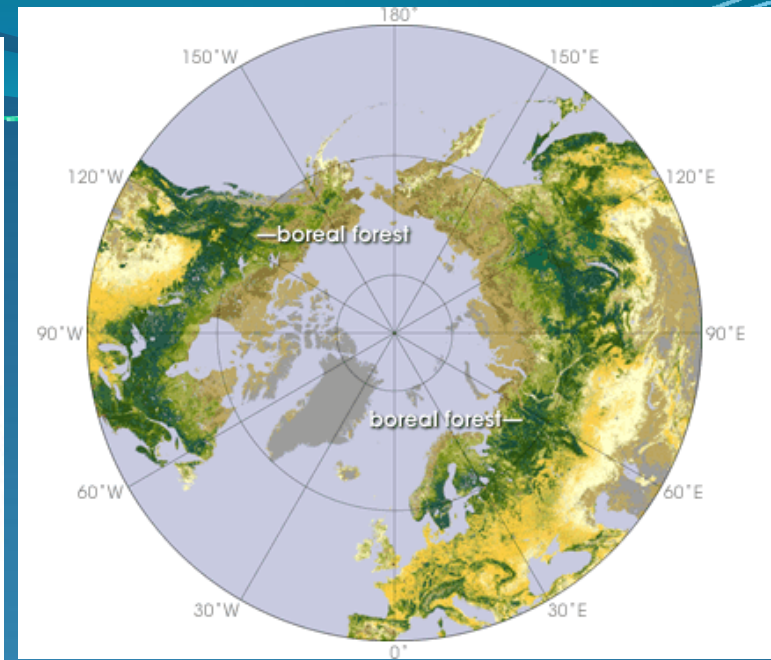
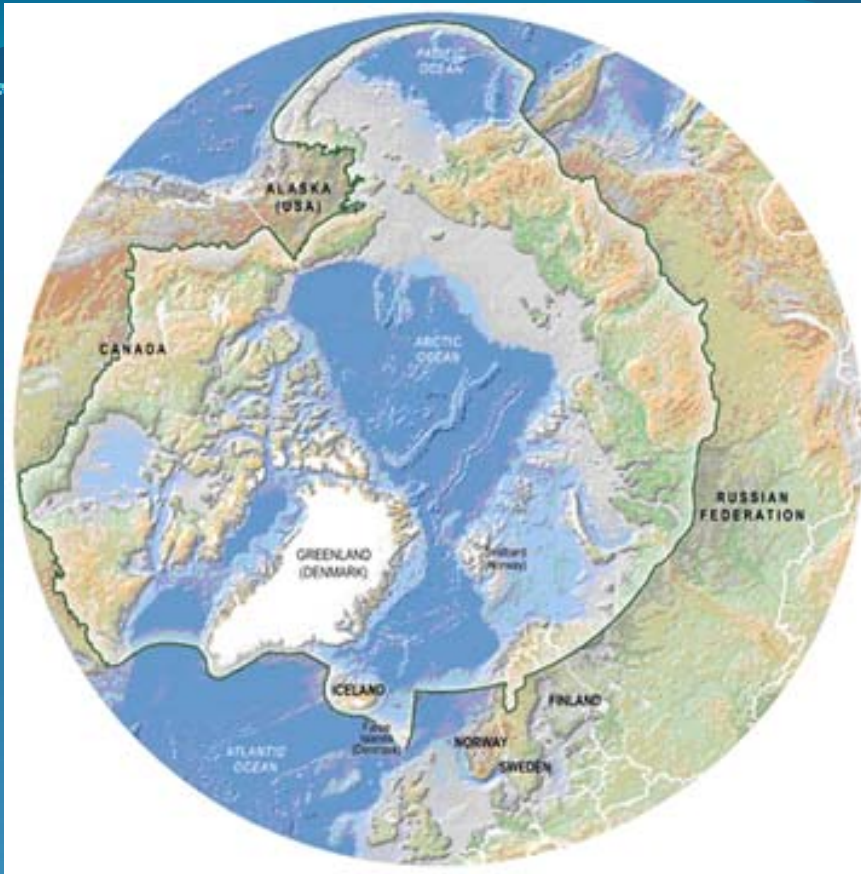
- MEDITERRANEAN**
- 21 HYPERDESERTIC-CONTINENTAL
- 22 HYPERDESERTIC-OCEANIC
- 23 DESERTIC-CONTINENTAL
- 24 DESERTIC-OCEANIC
- 25 XERIC-CONTINENTAL
- 26 XERIC-OCEANIC
- 27 PLUVIASEASONAL-CONTINENTAL
- 28 PLUVIASEASONAL-OCEANIC
- TEMPERATE**
- 32 XERIC
- 33 CONTINENTAL
- 34 OCEANIC
- 35 HYPEROCEANIC
- BOREAL**
- 41 XERIC
- 42 CONTINENTAL
- 43 SUB-CONTINENTAL
- 44 OCEANIC
- 45 HYPEROCEANIC
- POLAR**
- 51 PERIGLID
- 52 XERIC
- 53 CONTINENTAL
- 54 OCEANIC
- 55 HYPEROCEANIC

Diag	Pixels
23	20231
25	39997
27	32650
28	2268
31	72729
32	195721
33	60552
34	8055
41	29812
42	18308
43	462279
44	76393
45	14652
46	621
51	69688
52	12931
53	299128
54	13050
55	417



Cartographic Design: S. Rivas-Saenz
www.globalbioclimatics.org







Macrobioclimates (Rivas-Martínez - 2009 - *Global Bioclimatics*)

* **Polar:** 51° to 90° N and 53° to 90° S
Tp < 380 (100 m)

* **Boreal:** 43° to 71° N and 51° to 56 S

- Hyperoceanic (Ic \leq 11)
- Oceanic (Ic 11-21)
- Subcontinental (Ic 21-28)
- Eucontinental (Ic 28-46)
- Hypercontinental (Ic > 46)





Computerized Bioclimatic Maps
Bioclimates of North America

© 2008 V.B. S. Rivas-Martínez & S. Rivas-Sánchez
 M. Costa & D. Sánchez-Mata (PS)
 J. Giménez de Azcárate (México)
 M.G. Barbou (California)

USGS Hydro10k DEM (United Astronomical Equal Area)
 ESRI Arc Atlas - Atmosphere, 1996
 GlobalBioclimatics - GbcApi & GbcOci, 2007

- 500 Km
- TROPICAL**
 - 22 DESERTIC
 - 23 XERIC
 - 24 FLUVIOSEASONAL
 - 25 FLUVIAL
 - MEDITERRANEAN**
 - 27 HYPERDESERTIC-CONTINENTAL
 - 28 DESERTIC-CONTINENTAL
 - 29 DESERTIC-OCEANIC
 - 30 XERIC-CONTINENTAL
 - 31 XERIC-OCEANIC
 - 32 FLUVIOSEASONAL-CONTINENTAL
 - 33 FLUVIOSEASONAL-OCEANIC
 - TEMPERATE**
 - 34 XERIC
 - 35 CONTINENTAL
 - 36 OCEANIC
 - 37 HYPEROCEANIC
 - BORNEAL**
 - 41 XERIC
 - 42 CONTINENTAL
 - 43 SUB-CONTINENTAL
 - 44 OCEANIC
 - 45 HYPEROCEANIC
 - POLAR**
 - 46 PERIGLID
 - 47 XERIC
 - 48 CONTINENTAL
 - 49 OCEANIC
 - 50 HYPEROCEANIC

Map Scale: 1 km = 5 x 5 (Ka)
 Bitmap Area: 1821 x 1877
 Station Analyzer: 21 (nodes)
 Analyzed Area: 5 x 5 (pa)
 Recordset Stations: 5212
 -> Inside Map: 9400
 -> Inside Period: 9199
 -> Validated: 9900
 -> Accepted: 9679
 Analyzed Zones: 9700
 -> Stations Zones: 18031
 -> Bad Altitude: 500 (7 st)
 -> Bad Obser. Per.: 10 (200 st)
 -> Bad Year Temp.: 2 (84 st)
 -> Bad Year Rain.: 200 (182 st)
 Station of Means: 5 (422 st)
 -> Required Temp.: 2 (C)
 -> Required Data.: 200 (na)
 -> Required Cost.: 2 (C)
 -> Round/Macro: Yes/No
 Render by Altitude: 250 m
 -> Loop/Step: 25 m (Asc)
 -> Special Zones: 17 (7) x (8)
 -> Equal Areas: 40 (loop)
 Atmosphere Shapes: Yes
 -> July (T/P): 0.5 x 8
 -> Year (T/P): 0.5 x 8
 Station Generator: 1 x 1 (pa)
 -> Force Macro: 22 (st)
 -> Residual: 0.025 x 0.025 x 5
 -> Curve Station: 0.50 x 0.50 x 5
 -> Broken Curve: 5295 (4784)
 -> Temper by Alt.: Hyperbole of 2C
 -> Temper by Lat.: 0.500 x 0.500
 -> Curve Ration: 0.80 x 0.80 x 0
 -> Broken Curve: 0 (0)
 Estimated Stations: 960183 (pa)
 -> Same Diagnosis: 810319 (pa)
 -> Dif Diagnosis: 149864 (1837 st)
 -> Dif Macro: 644 (18 st)
 -> Dif Altitude: -45150 -> 7 762
 Data Base Missused: 145 (st)
 Data Base Most Used: 9641 (pa)

Diag	Pixels	Diag	Pixels
12	8009	13	61554
14	45095	15	11084
21	51	22	202
23	6252	24	2303
25	18937	26	4977
27	32213	28	17388
31	44878	32	211704
33	49484	34	1369
40	10	41	27859
42	15776	43	179746
44	17745	45	8440
46	702	51	61346
52	10531	53	176599
54	8355	55	454



Cartographic Design: S. Rivas-Sánchez
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 Circum Boreal Vegetation Mapping



Computerized Bioclimatic Maps

Thermytypes of North America

© 2008 VIII, S.Rivas Martínez & S.Rivas-Sáenz
 M.Costa & D.Sánchez-Mata (ES)
 J.Giménez de Aragón (México)
 M.C.Barber (California)

USGS Hydro1K DEM (Lambert Azimuthal Equal Area)
 ESRI Arc Atlas - Atmosphere, 1996
 GlobalBioclimatics - GbcApi & GbcDis, 2007

500 km

- TROPICAL**
- 11 INFRA-TROPICAL
 - 12 THERMO-TROPICAL
 - 13 MESO-TROPICAL
 - 14 SUPRA-TROPICAL
 - 15 ORO-TROPICAL
 - 16 CRYORO-TROPICAL

- MEDITERRANEAN**
- 21 INFRA-MEDITERRANEAN
 - 22 THERMO-MEDITERRANEAN
 - 23 MESO-MEDITERRANEAN
 - 24 SUPRA-MEDITERRANEAN
 - 25 ORO-MEDITERRANEAN

- TEMPERATE**
- 31 INFRA-TEMPERATE
 - 32 THERMO-TEMPERATE
 - 33 MESO-TEMPERATE
 - 34 SUPRA-TEMPERATE
 - 35 ORO-TEMPERATE
 - 36 CRYORO-TEMPERATE

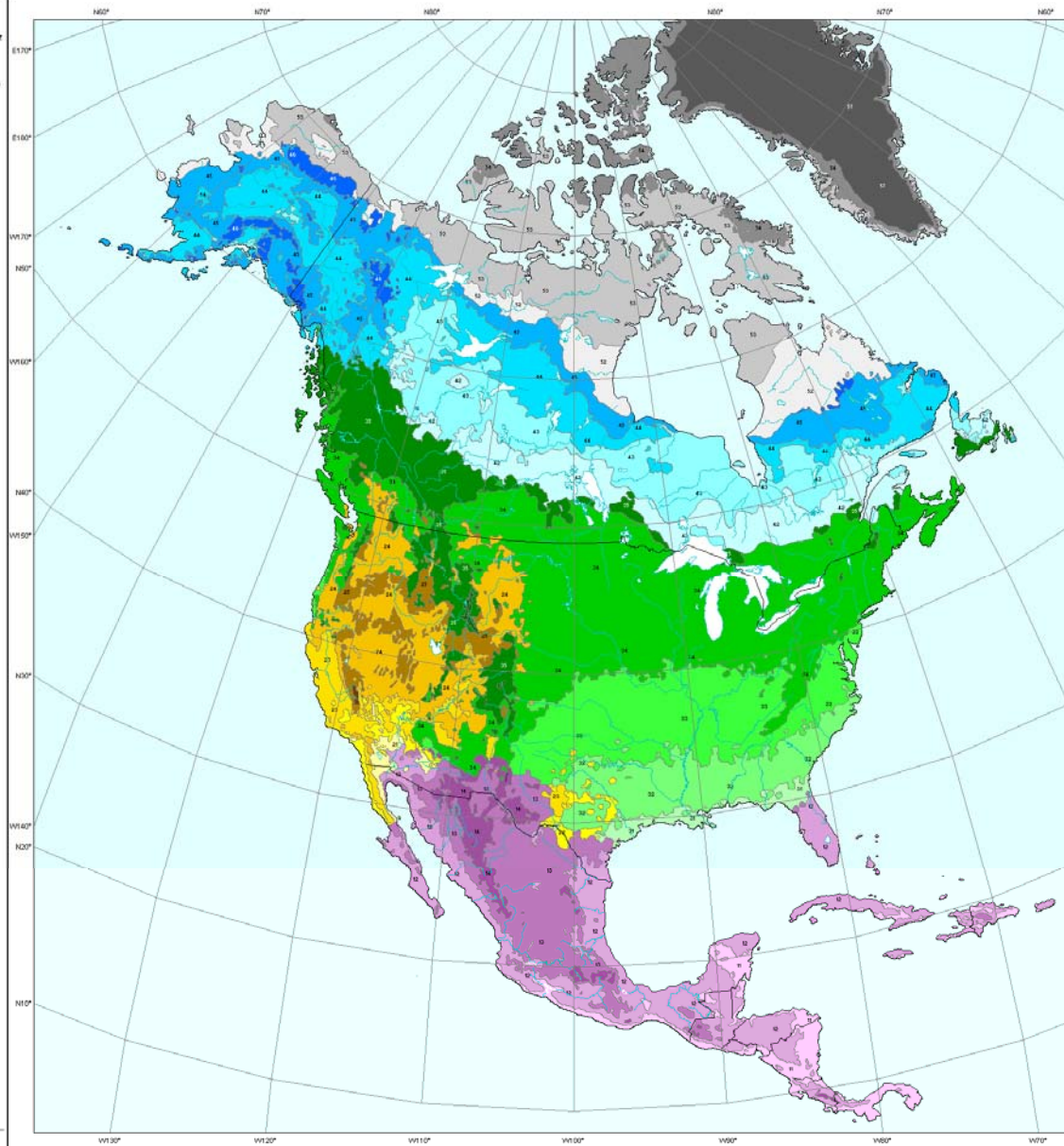
- BOREAL**
- 42 THERMO-BOREAL
 - 43 MESO-BOREAL
 - 44 SUPRA-BOREAL
 - 45 ORO-BOREAL
 - 46 CRYORO-BOREAL
 - 47 GELID

- POLAR**
- 52 THERMO-POLAR
 - 53 MESO-POLAR
 - 54 SUPRA-POLAR
 - 57 GELID

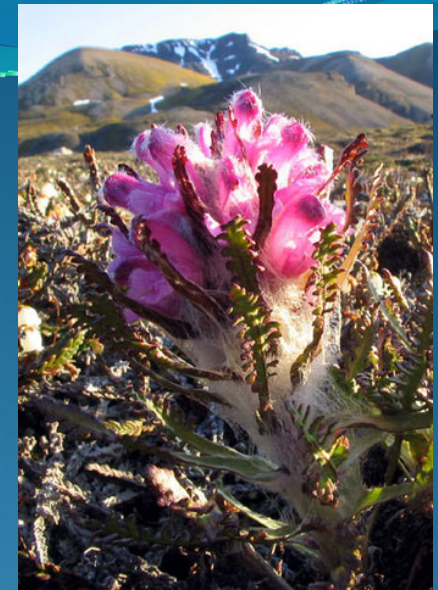
Map Scale: 1 px = 5 x 5 (Km)
 Bitmap Area 1821 px 1677
 Station Analyzer 11 (mode)
 Analyzed Area 5 x 5 (px)
 Recorderd Stations 13212
 -> Inside Map 9400
 -> Inside Period 9193
 -> Validated 9700
 -> Accepted 8679
 Analyzed Zones 9705
 -> Stations Zones 18001
 -> Bed Altitude 500 (7 st)
 -> Bed Closer Per 10 (200 st)
 -> Bed Year Temp 2 (86 st)
 -> Bed Year Rain 200 (162 st)
 Station of Means 5 (4221 st)
 -> Required Temp 2 (C)
 -> Required Rain 200 (mm)
 -> Required Cont 2 (C)
 -> Round/Macro Yes No
 Resizer by Altitude 250 m
 -> Loop/Step 25 x 4 (Acc)
 -> Special Zones 17 (V) 9 (R)
 -> Equal Areas 60 (loop)
 Atmospheric Slopes Yes
 -> July (T/P) 0 5 4 0
 -> Year (T/P) 0 5 78 5
 Station Generator 1 x 1 (px)
 -> Force Macro 22 (st)
 -> Radius 0 0 0 5 0 0 5
 Curve Ratios 0 50 0 50 4 5
 Broken Curve 5295 (4784)
 -> Temper by Alt Hypocbole of IC
 -> Temper by Lat 0 500 0 500
 Curve Ratios 0 80 0 80 2 0
 Broken Curve 0 (C)
 Estimated Stations 960183 (px)
 -> Same Diagonis 782915 (px)
 -> Di Diagonis 174358 (1877 st)
 -> Di Macro 644 (18 st)
 -> Di Altitude -45350 -7 742
 Data Base Misused 145 (st)
 Data Base Most Used 9541 (px)

Diag	Pixels	Diag	Pixels
11	18321	12	53450
13	42236	14	11464
15	279	21	3164
22	7309	23	13446
24	42838	25	15097
26	247	31	6167
32	31975	33	59600
34	155852	35	52322
36	659	42	39592
42	62950	44	48648
45	52323	46	10312
47	2	52	31480
53	91953	54	33489
57	58353		

Cartographic Design: S. Rivas-Sáenz
 www.globalbioclimatics.org

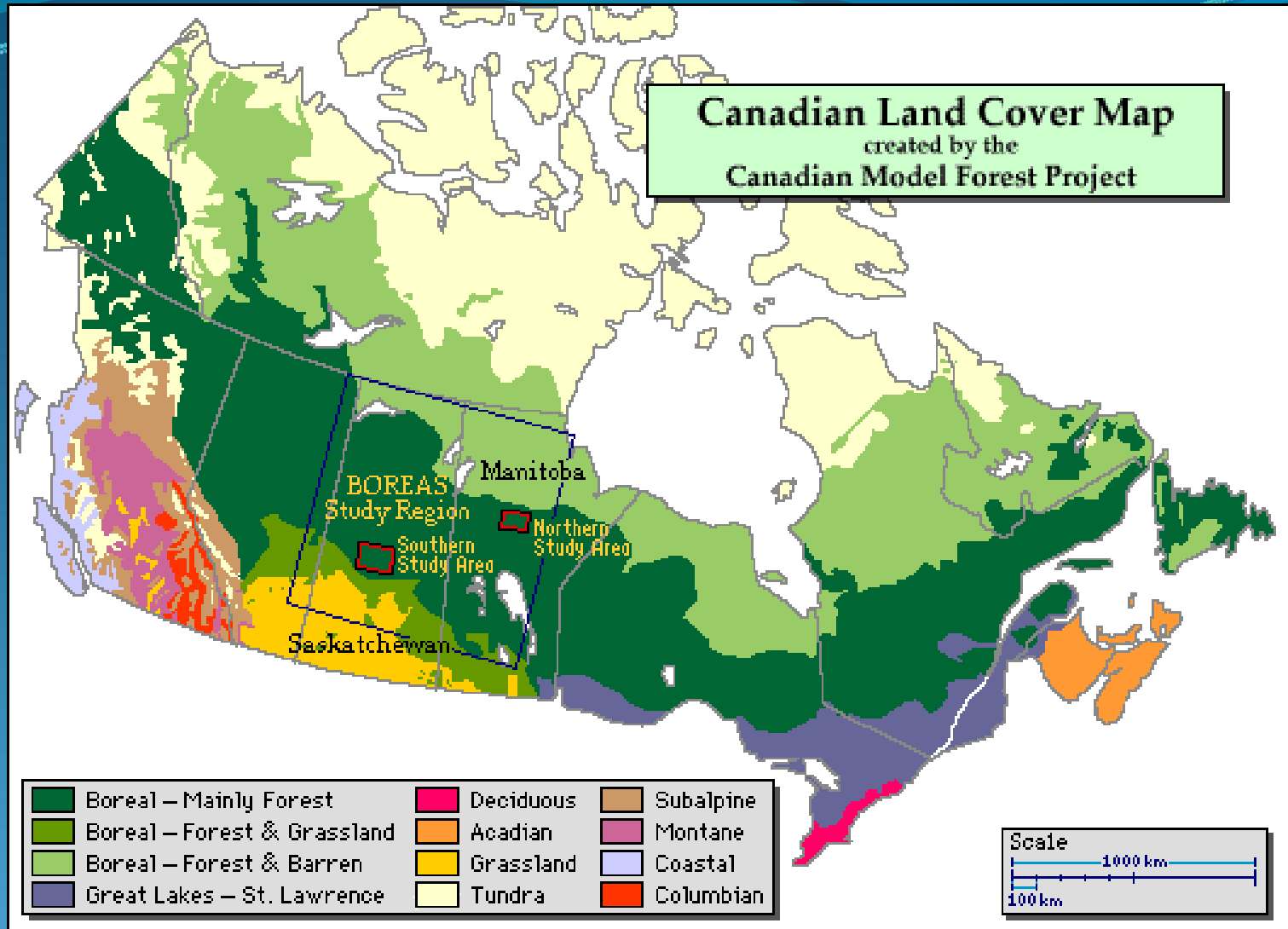


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 Circum Boreal Vegetation Mapping



CAFF
Cooperation of Arctic Flora and Fauna





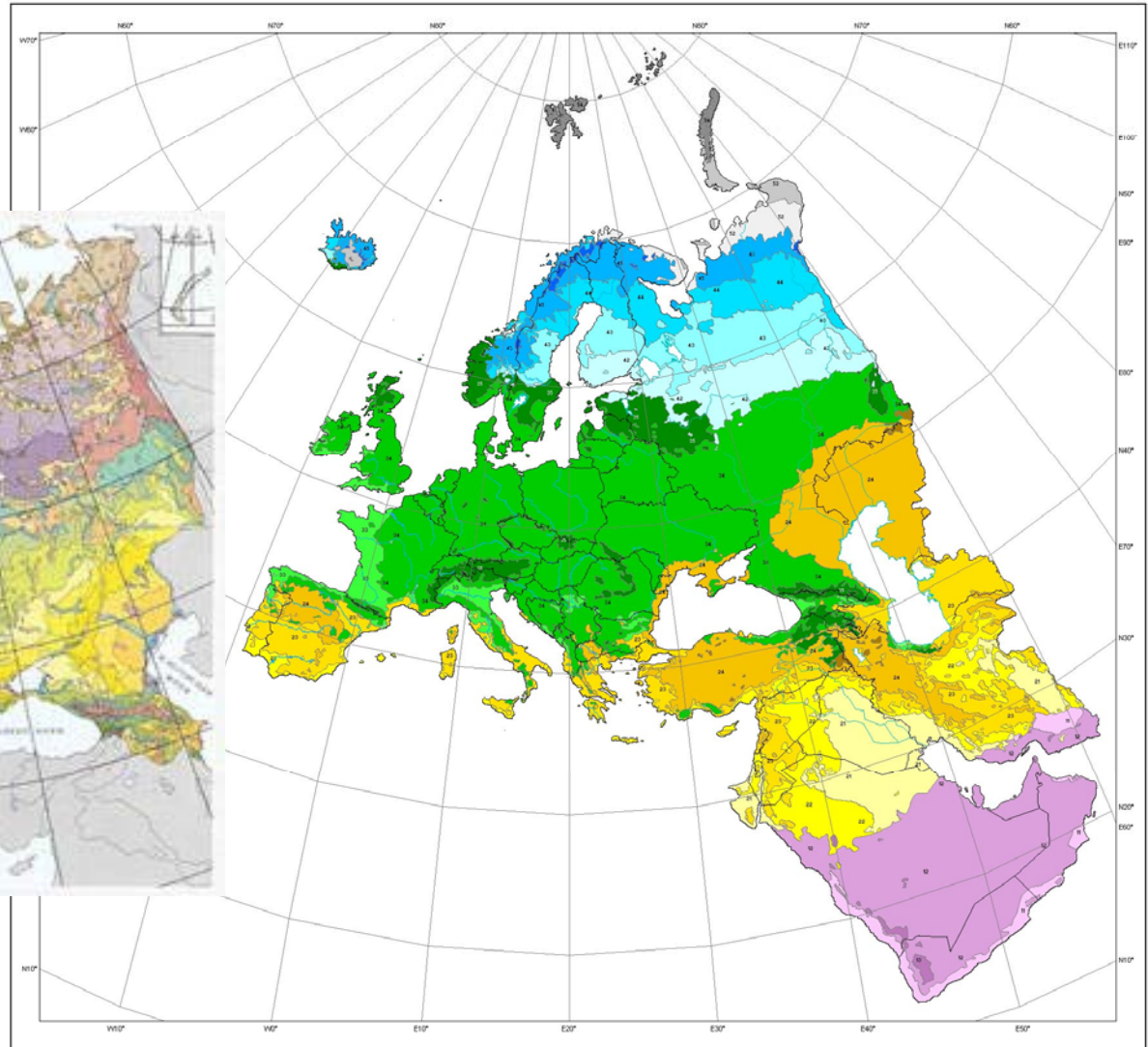


Computerized Bioclimatic Maps
Thermotypes of Europe & Mideast
 ©2008 - VII. S.Rivas Martínez & S.Rivas Sáenz

USGS Hydro1K DEM (Lambert Conformal Equal Area)
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Cartography Design: S. Rivas Sáenz www.globalbioclimatics.org
 Scale: 1 pixel = 5 Km² 500 Km

TROPICAL		MEDITERRANEAN		TEMPERATE		BORAL		POLAR	
11	SUB-TROPICAL	21	DISPA-MEDITERRANEAN	31	SUBPA-TEMPERATE	41	THERMO-BORAL	51	THERMO-POLAR
12	THERMO-TROPICAL	22	THERMO-MEDITERRANEAN	32	THERMO-TEMPERATE	42	MESO-BORAL	52	MESO-POLAR
13	MESO-TROPICAL	23	MESO-MEDITERRANEAN	33	MESO-TEMPERATE	43	SUBPA-BORAL	53	SUBPA-POLAR
14	SUBPA-TROPICAL	24	SUBPA-MEDITERRANEAN	34	SUBPA-TEMPERATE	44	CRYO-BORAL	54	CRYO-POLAR
15	CRYO-TROPICAL	25	CRYO-MEDITERRANEAN	35	CRYO-TEMPERATE	45	CRYO-BORAL	55	GELID
16	CRYO-TROPICAL			36	CRYO-TEMPERATE	46	GELID		



CAFF
 Center for Arctic Forest and Tundra





Computed Bioclimatic Maps
Biogeography of Asia
 © 2008 by Salvador Rivas-Martínez, Salvador
 Rivas-Sánchez, M. Isabel Fernández, T. Palomares & F. Álvarez
 UCLM Research Group on Land and Water Quality and
 Ecosystems, Almadén, 2008
 Global Bioclimatic - Atmospheric, 2008
 Global Bioclimatic - Climate & Bioclimatic, 2008
 Information Systems & Forest Science, www.geoinformatics.org
 Scale: 1 grid = 5 Grad 500 km

TROPICAL	TEMPERATE	COLD	ARCTIC	POLAR
1-12	13-14	15-16	17-18	19-20
21-22	23-24	25-26	27-28	29-30
31-32	33-34	35-36	37-38	39-40
41-42	43-44	45-46	47-48	49-50
51-52	53-54	55-56	57-58	59-60



Computed Bioclimatic Maps
Biogeography of Asia
 © 2008 by Salvador Rivas-Martínez, Salvador
 Rivas-Sánchez, M. Isabel Fernández, T. Palomares & F. Álvarez
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31-32	33-34	35-36	37-38	39-40
41-42	43-44	45-46	47-48	49-50
51-52	53-54	55-56	57-58	59-60





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* **Polar:** 51° to 90° N and 53° to 90° S
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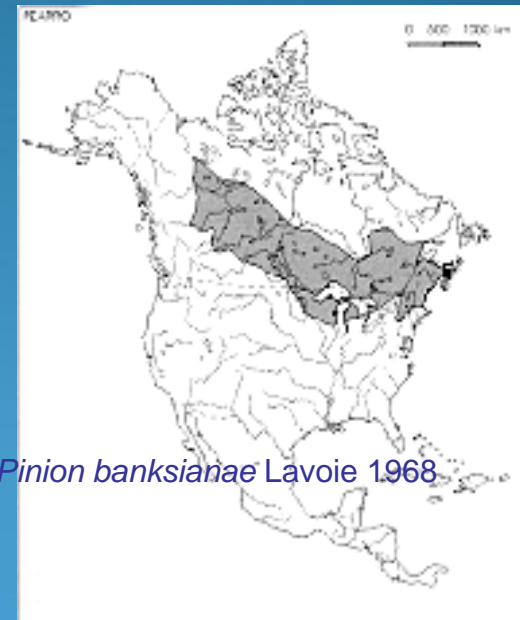
BOREAL BIOCLIMATE – VEGETATION RELATIONSHIPS (POTENTIAL NATURAL VEGETATION)

-The phytosociological approach is the more useful tool for mapping

purposes in broad territories (v.g. alliances)

-Complete experience and bibliographical coverage of the arctoboreal territories in the northern hemisphere in order to make a preliminary checklist of units to be mapped

- * North America: Alaska (USA), Canada
- * Europe: *Vegetation Map of Europe*
- * Eurasia, Siberia
- * East Asia



Pinion banksianae Lavoie 1968

