

Supplementary Material:

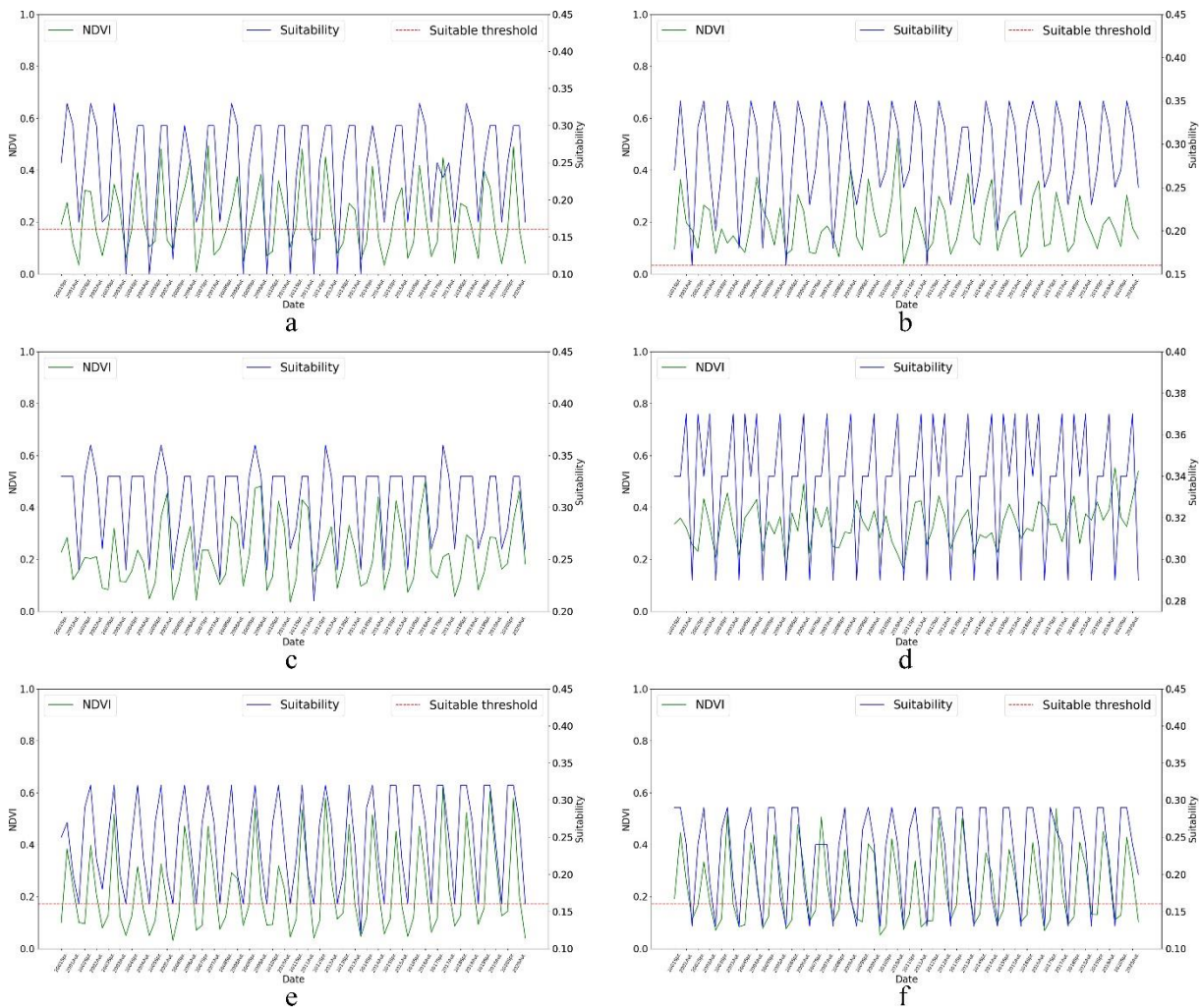


Figure S1. Time-series suitability comparisons with NDVI of (a) Shinotsu, (b) Kawakami, (c) Naganohara, (d) Kirishima, (e) Changchun, (f) Yanbian

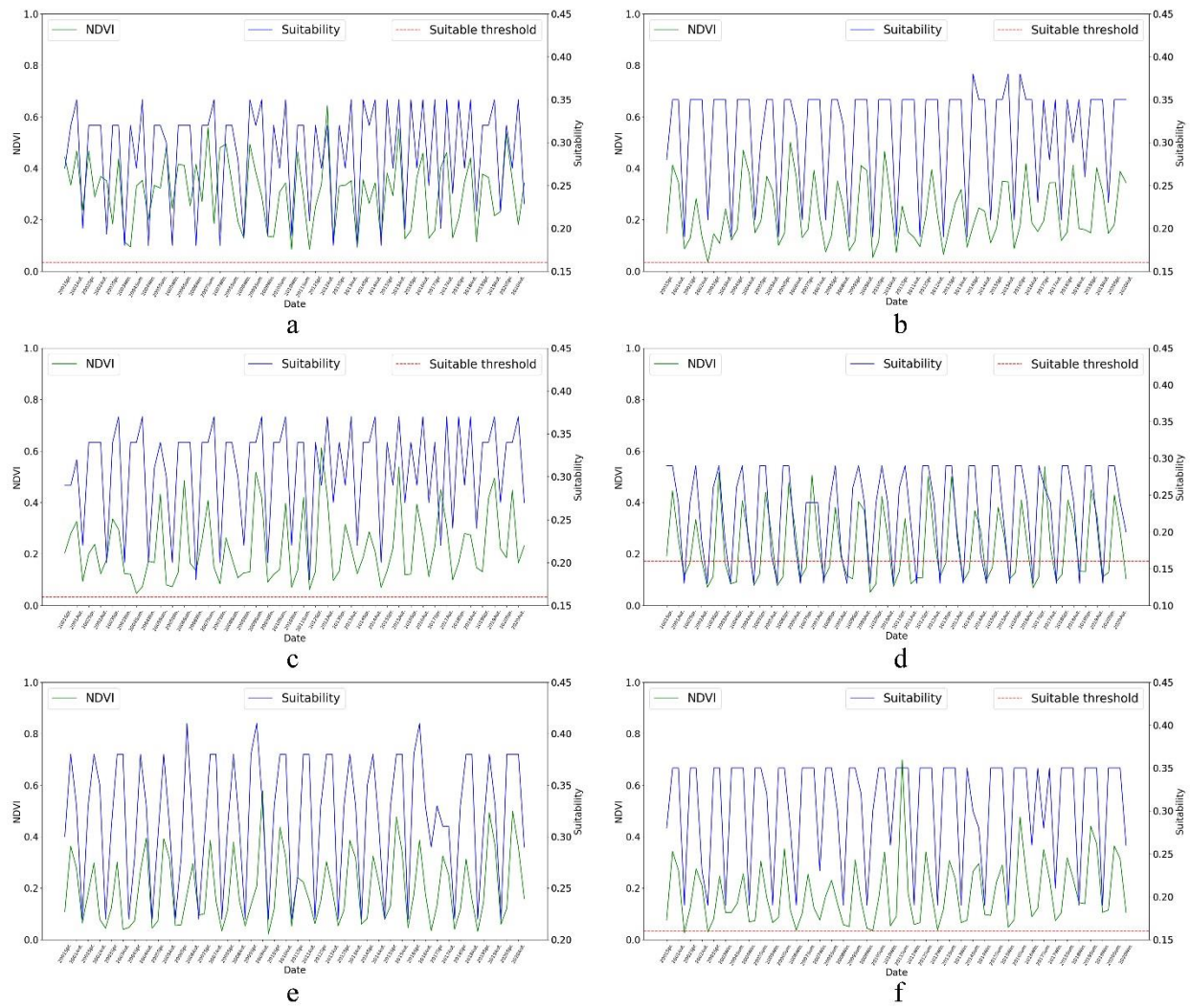


Figure S2. Time-series suitability comparisons with NDVI of (a) Gochang, (b) Goesan, (c) Muan, (d) Kyongwon, (e) Orang, (f) Pyongyangsong

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Table S1. Areas statistics of suitability level of 20 years in spring season

Year	Unsuitable	Marginal	Suitable	Optimal	Non-agricultural	Sum
2001	0.00	5699.48	228359.34	170333.57	524062.04	928454.42
2002	0.00	3378.15	103022.46	297801.28	524283.53	928485.41
2003	0.00	7207.16	180165.90	216358.66	524716.21	928447.92
2004	0.00	1182.75	208727.03	193288.94	525250.04	928448.76
2005	0.00	9177.41	197004.28	196407.31	525847.47	928436.48
2006	0.00	120.22	181701.24	220569.28	526078.48	928469.22
2007	0.00	2104.21	185353.06	214933.20	526053.30	928443.76
2008	0.00	3320.49	190761.18	208561.11	525794.77	928437.54
2009	0.00	64.30	180236.95	222263.30	525878.04	928442.60
2010	0.00	98.40	223558.13	178982.27	525837.04	928475.84
2011	0.00	235.59	241047.64	161468.14	525729.30	928480.67
2012	0.00	105.31	171121.13	231454.88	525785.02	928466.34
2013	0.00	1130.30	246608.07	154967.28	525748.93	928454.57
2014	0.00	288.98	142318.08	260237.01	525593.83	928437.91
2015	0.00	183.71	109143.47	293702.03	525428.02	928457.23
2016	0.00	0.00	109249.02	293819.04	525392.87	928460.93
2017	0.00	1216.37	101160.27	300970.21	525089.26	928436.11
2018	0.00	3.85	103807.35	299649.93	524978.50	928439.63
2019	0.00	233.51	101937.38	301672.26	524590.29	928433.43
2020	0.00	25.48	125903.19	277094.12	525417.43	928440.22

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Year	Unsuitable	Marginal	Suitable	Optimal	Non-agricultural	Sum
2001	0.00	0.00	45817.46	358602.93	524083.31	928503.7038
2002	0.00	0.00	29685.04	374554.25	524318.96	928558.2543
2003	0.00	0.00	21709.74	382112.43	524760.57	928582.7421
2004	0.00	0.12	35509.55	367750.75	525269.13	928529.5505
2005	0.00	0.00	28733.29	373930.84	525894.08	928558.2059
2006	0.00	0.23	28503.84	373956.85	526115.78	928576.7018
2007	0.00	0.00	41693.96	360759.32	526075.44	928528.7248
2008	0.00	0.00	34915.25	367804.06	525856.19	928575.4945
2009	0.00	0.00	19072.37	383578.11	525930.47	928580.9421
2010	0.00	0.00	46338.94	356350.29	525861.25	928550.4814
2011	0.00	0.00	32702.31	370085.13	525745.94	928533.3873
2012	0.00	0.00	34416.02	368309.22	525822.46	928547.6938
2013	0.00	0.00	40245.11	362513.77	525785.21	928544.0804
2014	0.00	0.00	39187.82	363741.63	525652.36	928581.8099
2015	0.00	0.00	40203.19	362881.71	525456.42	928541.3185
2016	0.00	0.00	36528.90	366569.79	525407.70	928506.3823
2017	0.00	75.46	113050.36	290270.19	525119.83	928515.8327
2018	0.00	0.00	42923.50	360593.42	525011.88	928528.8075
2019	0.00	0.00	33876.95	370018.91	524627.73	928523.5936
2020	0.00	0.00	37658.74	365441.99	525467.94	928568.6764

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Table S3. Areas statistics of suitability level of 20 years in autumn season

Year	Unsuitable	Marginal	Suitable	Optimal	Non-agricultural	Sum
2001	0.00	118.12	225507.73	178766.98	524061.26	928454.1
2002	0.00	745.35	260306.26	143118.37	524272.06	928442
2003	0.00	443.89	241875.66	161423.98	524721.02	928464.5
2004	0.00	132.20	203167.39	199917.59	525255.04	928472.2
2005	0.00	465.87	249451.43	152674.33	525852.61	928444.2
2006	0.00	53.18	191476.19	210870.44	526074.10	928473.9
2007	0.00	42.58	138902.14	263458.97	526063.34	928467
2008	0.00	769.69	265191.71	136697.25	525801.87	928460.5
2009	0.00	399.75	218773.57	183396.70	525884.15	928454.2
2010	0.00	97.92	174748.36	227791.73	525840.56	928478.6
2011	0.00	383.83	229861.08	172496.17	525724.74	928465.8
2012	0.00	9.00	133807.86	268869.97	525794.34	928481.2
2013	0.00	249.98	185952.17	216515.36	525755.14	928472.7
2014	0.00	422.40	217917.75	184510.42	525605.50	928456.1
2015	0.00	65.81	193622.64	209347.15	525430.54	928466.1
2016	0.00	86.83	164551.48	238447.32	525419.16	928504.8
2017	0.00	32.98	155052.50	248273.51	525103.89	928462.9
2018	0.00	0.00	124698.91	278770.79	524983.34	928453
2019	0.00	68.00	146787.06	256991.53	524598.98	928445.6
2020	0.00	0.00	123172.64	279869.49	525429.11	928471.2

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Table S4. Areas statistics of suitability level of 20 years in winter season

Year	Unsuitable	Marginal	Suitable	Optimal	Non-agricultural	Sum
2001	2043.84	63453.35	329458.37	8854.96	520045.93	923856.45
2002	1283.67	57704.43	332347.22	12300.41	520308.27	923944.00
2003	3827.83	73195.63	321446.31	4741.42	520749.87	923961.06
2004	3084.19	70679.23	317772.29	11126.29	521276.13	923938.12
2005	3459.00	80161.28	312777.72	5666.82	521882.37	923947.20
2006	1621.43	54777.33	336141.46	9325.94	522101.94	923968.10
2007	1244.20	53068.38	335816.47	11743.50	522078.62	923951.17
2008	3268.79	63957.53	323929.82	10987.71	521829.66	923973.51
2009	3795.76	64408.18	319654.94	14182.56	521906.43	923947.87
2010	3848.03	67472.30	315972.37	14828.05	521862.86	923983.62
2011	4592.80	74227.20	317541.74	5854.79	521744.25	923960.78
2012	5508.78	66396.27	321491.98	8758.38	521805.25	923960.66
2013	3605.46	97764.16	291899.59	8907.15	521773.49	923949.86
2014	1003.28	53030.39	336657.94	11630.48	521635.70	923957.79
2015	1071.59	57350.54	333094.42	10974.74	521447.27	923938.56
2016	310.08	40267.13	341647.22	20339.66	521431.68	923995.76
2017	2064.11	57195.78	329211.20	14340.92	521116.22	923928.23
2018	3620.50	52979.77	336910.15	9421.41	521012.24	923944.07
2019	829.67	50682.09	336143.58	15658.14	520630.43	923943.91
2020	1323.40	54201.16	320176.19	26776.66	521451.85	923929.26