 doi:10.20944/preprints202201.0123.v1

Article

Genus-Physiognomy-Ecosystem Map with 88 Legends Produced at 10m-resolution First-time in a Country Scale through Machine Learning of Multi-temporal Satellite Images

Ram C. Sharma and Keitarou Hara

Department of Informatics, Tokyo University of Information Sciences, 4-1 Onaridai, Wakaba-ku, Chiba 265 8501, Japan

*Correspondence: ram-c-sha@pm.me; Tel.: +81-43-236-4603.

Abstract:

This research introduces Genus-Physiognomy-Ecosystem (GPE) mapping at a prefecture level through machine learning of multi-spectral and multi-temporal satellite images at 10m spatial resolution, and later integration of prefecture wise maps into country scale for dealing with 88 GPE types to be classified from a large size of training data involved in the research effectively. This research was made possible by harnessing entire archives of Level-2A product, Bottom of Atmosphere reflectance images collected by MultiSpectral Instruments onboard a constellation of two polar-orbiting Sentinel-2 mission satellites. The satellite images were pre-processed for cloud masking and monthly median composite images consisting of 10 multi-spectral bands and 7 spectral indexes were generated. The ground truth labels were extracted from extant vegetation survey maps by implementing systematic stratified sampling approach and noisy labels were dropped out for preparing a reliable ground truth database. Graphics Processing Unit (GPU) implementation of Gradient Boosting Decision Trees (GBDT) classifier was employed for classification of 88 GPE types from 204 satellite features. The classification accuracy computed with 25% test data varied from 65-81% in terms of F1-score across 48 prefectural regions. This research produced seamless maps of 88 GPE types first time at a country scale with an average 72% F1-score.

Keywords: Sentinel-2, Land cover, Vegetation, Mapping, Plant communities, Machine learning, Genus-Physiognomy-Ecosystem, Gradient Boosting Decision Trees

 doi:10.20944/preprints202201.0123.v1

1. Introduction

Amplification of anthropogenic activities such as land use changes and overexploitation of natural resources has disturbed terrestrial ecosystems worldwide (Foley et al., 2005; Chen et al., 2014; Lehosmaa et al., 2017). Climate change has further intensified such disturbances in many vulnerable ecosystems (Grimm et al., 2013; Schirpke et al., 2017; Li et al., 2018). Vegetation mapping is an essential endeavor in the conservation and management of biodiversity and ecosystem services to pursue interrelationships between ecosystems and environmental changes caused by anthropogenic or natural drivers (Henderson et al., 2019; Schrodt et al., 2020; Bowler et al., 2020; Sharma, 2021).

Though some broad categories of vegetation types such as forests, shrublands, grasslands, and cultivated lands, etc. have been incorporated by land use and land cover maps (Running et al., 1995; Cihlar, 2000) and further subdivision into physiognomic categories such as evergreen/deciduous conifer/broadleaf forests (Sharma et al., 2017) by them, vegetation mapping can be described as a specialized field that is mostly focused on the mapping of plant communities.

Defining a plant community, as a relatively uniform collection of plant species distinguishable from its neighboring patches (Poore, 1955), is not straightforward and researchers have attempted different systems for the organization of vegetation types or plant communities with the support of different criteria such as bioclimatic, ecosystem, physiognomy, phytosociological association, and dominant species (Bredenkamp et al., 1998). Out of these criteria, bioclimatic, ecosystem and physiognomic criteria are too broad and applicable for classifying vegetation types at coarse scales; whereas criteria of dominant species is too complex and may be impractical for large-scale applications (Sharma, 2021). Since phytosociological association is based on characteristic species rather than dominant species (Whittaker, 1980), it is out from remote sensing-based applications as canopy reflectance are determined by dominant species instead of characteristic species. In line to this, Sharma (2021) developed a dominant Genus-Physiognomy-Ecosystem (GPE) system as an

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

appropriate system for large-scale classification of plant communities from satellite images. In the GPE system, a plant community is defined with inference to genus, physiognomy, and ecosystem; such as Quercus evergreen broadleaf forests, Quercus deciduous broadleaf forests, Quercus shrub, Alpine herb, Coastal shrub, Wetland herb, etc.

The major objective of this research is operational mapping and production of Genus-Physiognomy-Ecosystem (GPE) maps at 10m spatial resolution at a country scale by harnessing Sentinel-2 multi-temporal images.

2. Materials and Methods

2.1. Study area

It covers the whole country comprising of 47 prefectures. Since Hokkaido prefecture was split into two parts, this research deals with 48 prefectural regions. Table 1 shows the list of prefectural regions used in the research.

Table 1. List of prefectural regions used in the research.

1. Aichi	25. Miyagi
2. Akita	26. Miyazaki
3. Aomori	27. Nagano
4. Chiba	28. Nagasaki
5. Ehime	29. Nara
6. Fukui	30. Niigata
7. Fukuoka	31. Oita
8. Fukushima	32. Okayama
9. Gifu	33. Okinawa
10. Gunma	34. Osaka
11. Hiroshima	35. Saga
12. HokkaidoA	36. Saitama
13. HokkaidoB	37. Shiga
14. Hyogo	38. Shimane
15. Ibaraki	39. Shizuoka
16. Ishikawa	40. Tochigi
17. Iwate	41. Tokushima
18. Kagawa	42. Tokyo
19. Kagoshima	43. Tottori
20. Kanagawa	44. Toyama
21. Kochi	45. Wakayama
22. Kumamoto	46. Yamagata
23. Kyoto	47. Yamaguchi

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.2. Enumeration of GPE classes

The plant community types were enumerated for each prefecture by adopting a dominant Genus-Physiognomy-Ecosystem (GPE) system developed in previous study (Sharma, 2021) for satellite-based classification and mapping of plant communities at a large scale. The phytosociological association-based community types available from extant vegetation survey reports (MoE, 1999) were taken as reference materials for enumerating GPE classes for each prefecture. The GPE classes were further confirmed by field observations carried out between 2017 and 2021 in many prefectures. Appendix 1 shows the list of GPE classes enumerated in all prefectures including some land cover classes.

2.3. Preparation of ground truth labels

The ground truth labels were extracted from extant vegetation survey maps (MoE, 1999) by implementing systematic stratified sampling approach and noisy labels were dropped out for preparing a reliable ground truth database.

2.4. Processing of satellite data

All Level-2A product images collected by Sentinel-2 mission satellites between 2018-2019 in all prefectures were processed. For each scene, cloud masking was done and ten spectral bands were extracted; and seven spectral indexes were calculated. Table 2 shows the list of spectral indexes used in the research.

Table 2. List of spectral indexes used in the research.

Ind**exes**	Reference
Normalized Difference Vegetation Index (NDVI)	Rouse et al., 1974
Normalized Difference Water Index (NDWI)	McFeeters, 1996
Land Surface Water Index (LSWI)	Chandrasekar et al., 2010
Green Red Vegetaton Index (GRVI)	Falkowski et al., 2005
Red Edge Normalized Difference Vegetation Index (RENDVI)	Gitelson and Merzlyak, 1998
Atmospherically Resistant Vegetation Index (ARVI)	Kaufman and Tanre, 1992
Modified Chlorophyll Absorption Ratio Index (MCARI)	Daughtry et al., 2000

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

The spectral bands and spectral index images were composited by computing monthly median values. This procedure resulted 204 features in total.

2.5. Machine learning and classification

Gradient Boosting Decision Trees (GBDT; Chen et al., 2016) classifier with GPU implementation was employed for the supervised classification of satellite images by the handling of large size of training data. A train-test split method was utilized for fine tuning of input features and model parameters with reference to classification accuracy metrics (Kappa coefficient and F1-score). Each prefecture was modeled and mapped separately.

3. Results

3.1. Model test accuracies

Appendix 2 shows model's test accuracies in terms of Kappa coefficient and F1-score calculated class wise for each prefecture. Summary of average accuracies across all classes for each prefecture has been shown in Table 2.

Table 2. Summary of model's test accuracies calculated as average accuracies across all classes.

Prefecture	Kappa	F1-score
Aichi	0.647	0.663
Akita	0.784	0.793
Aomori	0.759	0.768
Chiba	0.718	0.737
Ehime	0.68	0.694
Fukui	0.733	0.745
Fukuoka	0.695	0.713
Fukushima	0.754	0.762
Gifu	0.723	0.732
Gunma	0.708	0.718
Hiroshima	0.715	0.729
HokkaidoA	0.749	0.757
HokkaidoB	0.774	0.783
Hyogo	0.704	0.717
Ibaraki	0.669	0.686
Ishikawa	0.730	0.742
Iwate	0.751	0.760
Kagawa	0.699	0.720
Kagoshima	0.716	0.726

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

Kanagawa	0.638	0.650
Kochi	0.713	0.727
Kumamoto	0.752	0.765
Kyoto	0.734	0.750
Mie	0.696	0.711
Miyagi	0.763	0.773
Miyazaki	0.667	0.679
Nagano	0.744	0.752
Nagasaki	0.726	0.74
Nara	0.722	0.738
Niigata	0.746	0.754
Oita	0.708	0.722
Okayama	0.718	0.733
Okinawa	0.697	0.716
Osaka	0.657	0.680
Saga	0.663	0.682
Saitama	0.728	0.742
Shiga	0.656	0.669
Shimane	0.720	0.734
Shizuoka	0.697	0.708
Tochigi	0.714	0.723
Tokushima	0.699	0.711
Tokyo	0.710	0.721
Tottori	0.740	0.753
Toyama	0.748	0.757
Wakayama	0.671	0.687
Yamagata	0.805	0.811
Yamaguchi	0.702	0.719
Yamanashi	0.708	0.719

3.2. GPE maps

The prefectural region wise Genus-Physiognomy-Ecosystem (GPE) maps produced in this research have been shown in Appendix 3. These maps can be merged altogether to produce a countrywide GPE map. The prefectural regions utilized in this environmental research were taken as references from land numerical information data version 2.3 provided by Ministry of Land, Infrastructure, Transport and Tourism (MLIT). Very small islands may have missed in some prefectural regions due to lack of satellite images.

4. Conclusions

Maintenance of high-resolution land cover and vegetation information at a country level is a challenging task. Though vegetation maps were produced in the country by manual

delineation of phytosociological association-based communities, this procedure is not only laborious and costly, it also incurs inconsistency and human discernment. This research demonstrated production of Genus-Physiognomy-Ecosystem (GPE) maps with 88 legends first time at a country scale by harnessing multi-temporal satellite images. Further increase in the accuracy of the GPE maps by strengthening the quality of ground truth labels is the subject of future research.

Author Contributions: R. Sharma conceived the research, performed the research, and wrote the manuscript. K. Hara provided logistic support to the research. Both authors have read and agreed to the published version of the manuscript.

Acknowledgements: This research was partially supported by JSPS Grant-in-Aid for Scientific Research (JP19H04320).

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Bowler, D.E.; Bjorkman, A.D.; Dornelas, M.; Myers-Smith, I.H.; Navarro, L.M.; Niamir, A.; Supp, S.R.; Waldock, C.; Winter, M.; Vellend, M.; et al. Mapping Human Pressures on Biodiversity across the Planet Uncovers Anthropogenic Threat Complexes. *People and Nature* 2020, *2*, 380–394, doi:10.1002/pan3.10071.
2. Bredenkamp, G.; Chytrý, M.; Fischer, H.S.; Neuhäuslová, Z.; van der Maarel, E. Vegetation Mapping: Theory, Methods and Case Studies: Introduction. *Applied Vegetation Science* 1998, *1*, 162–164.
3. Chandrasekar, K.; Sesha Sai, M.V.R.; Roy, P.S.; Dwevedi, R.S. Land Surface Water Index (LSWI) Response to Rainfall and NDVI Using the MODIS Vegetation Index Product. *International Journal of Remote Sensing* 2010, *31*, 3987–4005, doi:10.1080/01431160802575653.
4. Chen, B.; Zhang, X.; Tao, J.; Wu, J.; Wang, J.; Shi, P.; Zhang, Y.; Yu, C. The Impact of Climate Change and Anthropogenic Activities on Alpine Grassland over the Qinghai-Tibet Plateau. *Agricultural and Forest Meteorology* 2014, *189–190*, 11–18, doi:10.1016/j.agrformet.2014.01.002.
5. Chen, T.; Guestrin, C. XGBoost: A Scalable Tree Boosting System. In Proceedings of the Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining; ACM: San Francisco California USA, August 13 2016; pp. 785–794.
6. Cihlar, J. Land Cover Mapping of Large Areas from Satellites: Status and Research Priorities. *International Journal of Remote Sensing* 2000, *21*, 1093–1114, doi:10.1080/014311600210092.
7. Daughtry, C. Estimating Corn Leaf Chlorophyll Concentration

from Leaf and Canopy Reflectance. *Remote Sensing of Environment* 2000, *74*, 229–239, doi:10.1016/S0034-4257(00)00113-9.

8. Falkowski, M.J.; Gessler, P.E.; Morgan, P.; Hudak, A.T.; Smith, A.M.S. Characterizing and Mapping Forest Fire Fuels Using ASTER Imagery and Gradient Modeling. *Forest Ecology and Management* 2005, *217*, 129–146, doi:10.1016/j.foreco.2005.06.013.
9. Foley, J.A.; DeFries, R.; Asner, G.P.; Barford, C.; Bonan, G.; Carpenter, S.R.; Chapin, F.S.; Coe, M.T.; Daily, G.C.; Gibbs, H.K.; et al. Global Consequences of Land Use. *Science* 2005, *309*, 570–574, doi:10.1126/science.1111772.
10. Gitelson, A.A.; Merzlyak, M.N. Remote Sensing of Chlorophyll Concentration in Higher Plant Leaves. *Advances in Space Research* 1998, *22*, 689–692, doi:10.1016/S0273-1177(97)01133-2.
11. Grimm, N.B.; Chapin, F.S.; Bierwagen, B.; Gonzalez, P.; Groffman, P.M.; Luo, Y.; Melton, F.; Nadelhoffer, K.; Pairis, A.; Raymond, P.A.; et al. The Impacts of Climate Change on Ecosystem Structure and Function. *Frontiers in Ecology and the Environment* 2013, *11*, 474–482, doi:10.1890/120282.
12. Henderson, E.B.; Bell, D.M.; Gregory, M.J. Vegetation Mapping to Support Greater Sage-grouse Habitat Monitoring and Management: Multi- or Univariate Approach? *Ecosphere* 2019, *10*, doi:10.1002/ecs2.2838.
13. Kaufman, Y.J.; Tanre, D. Atmospherically Resistant Vegetation Index (ARVI) for EOS-MODIS. *IEEE Trans. Geosci. Remote Sensing* 1992, *30*, 261–270, doi:10.1109/36.134076.
14. Lehosmaa, K.; Jyväsjärvi, J.; Virtanen, R.; Ilmonen, J.; Saastamoinen, J.; Muotka, T. Anthropogenic Habitat Disturbance Induces a Major Biodiversity Change in Habitat Specialist Bryophytes of Boreal Springs. *Biological Conservation* 2017, *215*, 169–178, doi:10.1016/j.biocon.2017.09.010.
15. Li, D.; Wu, S.; Liu, L.; Zhang, Y.; Li, S. Vulnerability of the Global Terrestrial Ecosystems to Climate Change. *Glob Change Biol* 2018, *24*, 4095–4106, doi:10.1111/gcb.14327.
16. McFEETERS, S.K. The Use of the Normalized Difference Water Index (NDWI) in the Delineation of Open Water Features. *International Journal of Remote Sensing* 1996, *17*, 1425–1432, doi:10.1080/01431169608948714.
17. Miyawaki, A.; Fujiwara, K. Vegetation Mapping in Japan. In *Vegetation mapping*; Küchler, A.W., Zonneveld, I.S., Eds.; Springer Netherlands: Dordrecht, 1988; pp. 427–441 ISBN 978-94-010-7885-6.
18. MoE Nature Conservation Bureau, Ministry of the Environment of Japan and Asia Air Survey Co., Ltd. The 5th National Survey on the Natural Environment (Vegetation Survey) Report 1999.
19. Poore, M.E.D. The Use of Phytosociological Methods in Ecological Investigations: I. The Braun-Blanquet System. *The Journal of Ecology* 1955, *43*, 226, doi:10.2307/2257132.

20. Rouse, J.W.; Haas, R.H.; Schell, J.A.; Deering, D.W. Monitoring Vegetation Systems in the Great Plains with ERTS. *NASA special publication* 1974, *351*, 309.
21. Running, S.W.; Loveland, T.R.; Pierce, L.L.; Nemani, R.R.; Hunt, E.R. A Remote Sensing Based Vegetation Classification Logic for Global Land Cover Analysis. *Remote Sensing of Environment* 1995, *51*, 39–48, doi:10.1016/0034-4257(94)00063-S.
22. Schirpke, U.; Kohler, M.; Leitinger, G.; Fontana, V.; Tasser, E.; Tappeiner, U. Future Impacts of Changing Land-Use and Climate on Ecosystem Services of Mountain Grassland and Their Resilience. *Ecosystem Services* 2017, *26*, 79–94, doi:10.1016/j.ecoser.2017.06.008.
23. Schrodt, F.; de la Barreda Bautista, B.; Williams, C.; Boyd, D.S.; Schaepman-Strub, G.; Santos, M.J. Integrating Biodiversity, Remote Sensing, and Auxiliary Information for the Study of Ecosystem Functioning and Conservation at Large Spatial Scales. In *Remote Sensing of Plant Biodiversity*; Cavender-Bares, J., Gamon, J.A., Townsend, P.A., Eds.; Springer International Publishing: Cham, 2020; pp. 449–484 ISBN 978-3-030-33156-6.
24. Sharma, R.C. Genus-Physiognomy-Ecosystem (GPE) System for Satellite-Based Classification of Plant Communities. *Ecologies* 2021, *2*, 203–213, doi:10.3390/ecologies2020012.
25. Sharma, R.C. Vegetation Structure Index (VSI): Retrieving Vegetation Structural Information from Multi-Angular Satellite Remote Sensing. *J. Imaging* 2021, *7*, 84, doi:10.3390/jimaging7050084.
26. Sharma, R.C.; Hara, K.; Hirayama, H. A Machine Learning and Cross-Validation Approach for the Discrimination of Vegetation Physiognomic Types Using Satellite Based Multispectral and Multitemporal Data. *Scientifica* 2017, *2017*, 1–8, doi:10.1155/2017/9806479.
27. Whittaker, R.H. *Classification of Plant Communities*; Springer Netherlands: Dordrecht, 1980; ISBN 978-94-009-9183-5.

Appendix 1.

List of GPE classes enumerated in all prefectural regions including some land cover classes.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

1. Abandoned land	45. Mallotus DBF
2. Abies ECF	46. Mangroves EBF
3. Acacia EBF	47. Melia DBF
4. Acer DBF	48. Miscanthus Herb
5. Acer Shrub	49. Open space Herb
6. Alnus DBF	50. Paddy field
7. Alnus Shrub	51. Palm ECF
8. Alpine Herb	52. Pandanus ECF
9. Alpine Shrub	53. Pasture
10. Ardisia EBF	54. Picea ECF
11. Bamboo EBF	55. Pinus ECF
12. Bamboo Shrub	56. Pinus Shrub
13. Barren	57. Podocarpus ECF
14. Betula DBF	58. Pongamia EBF
15. Builtup	59. Populus DBF
16. Calamagrostis Herb	60. Prunus DBF
17. Camellia EBF	61. Pterocarya DBF
18. Carpinus DBF	62. Pterostyrax DBF
19. Carpinus Shrub	63. Quercus DBF
20. Castanopsis EBF	64. Quercus EBF
21. Celtis DBF	65. Quercus Shrub
22. Cercidiphyllum DBF	66. Rhododendron Shrub
23. Coastal Herb	67. Robinia DBF
24. Cornus DBF	68. Salix DBF
25. Costal Shrub	69. Salix Shrub
26. Cryptomeria-Chamaecyparis ECF	70. Sasa Shrub
27. Deciduous Shrub	71. Schima EBF
28. Diospyros EBF	72. Sciadopitys ECF
29. Elaeagnus Shrub	73. Sorbus DBF
30. Elaeocarpus EBF	74. Stewartia DBF
31. Euptelea DBF	75. Thuja ECF
32. Eurya ECF	76. Thujopsis ECF
33. Evodia DBF	77. Tilia DBF
34. Fagus DBF	78. Treefern ECF
35. Fraxinus DBF	79. Trema EBF
36. Hibiscus EBF	80. Trochodendron EBF
37. Hydrangea Shrub	81. Tsuga ECF
38. Juglans DBF	82. Ulmus DBF
39. Juniperus Shrub	83. Upland field
40. Lagestroemia DBF	84. Water
41. Larix DCF	85. Weigela Shrub
42. Lithocarpus EBF	86. Wetland Herb
43. Litsea EBF	87. Zelkova DBF

 doi:10.20944/preprints202201.0123.v1

44. Machilus EBF	88. Zoysia Herb

Appendix 2.

Model's test accuracies in each prefectural region obtained class wise in the research.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.1. Aichi prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.519	0.540
2	Abies ECF	0.589	0.594
3	Alnus DBF	0.532	0.532
4	Alpine Herb	0.677	0.678
5	Bamboo EBF	0.854	0.883
6	Barren	0.638	0.672
7	Builtup	0.587	0.625
8	Carpinus DBF	0.735	0.740
9	Castanopsis EBF	0.554	0.560
10	Coastal Herb	0.763	0.764
11	Cryptomeria-Chamaecyparis ECF	0.664	0.691
12	Deciduous Shrub	0.530	0.531
13	Fagus DBF	0.733	0.734
14	Larix DCF	0.600	0.601
15	Machilus EBF	0.583	0.586
16	Mallotus DBF	0.546	0.571
17	Miscanthus Herb	0.552	0.573
18	Open space Herb	0.684	0.717
19	Paddy field	0.642	0.670
20	Pasture	0.755	0.763
21	Pinus ECF	0.727	0.766
22	Quercus DBF	0.733	0.775
23	Quercus EBF	0.739	0.775
24	Robinia DBF	0.535	0.536
25	Salix DBF	0.579	0.581
26	Salix Shrub	0.537	0.540
27	Sasa Shrub	0.469	0.470
28	Tsuga ECF	0.796	0.797
29	Upland field	0.776	0.816
30	Water	0.707	0.729
31	Wetland Herb	0.544	0.560
32	Zelkova DBF	0.827	0.835

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.2. Akita prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.814	0.823
2	Abies ECF	0.886	0.887
3	Acer Shrub	0.980	0.980
4	Alnus DBF	0.896	0.897
5	Alpine Herb	0.790	0.791
6	Barren	0.827	0.846
7	Betula DBF	0.764	0.767
8	Builtup	0.721	0.739
9	Carpinus DBF	0.860	0.861
10	Coastal Herb	0.681	0.682
11	Cryptomeria-Chamaecyparis ECF	0.624	0.649
12	Deciduous Shrub	0.634	0.634
13	Fagus DBF	0.631	0.654
14	Fraxinus DBF	0.704	0.704
15	Hydrangea Shrub	0.859	0.872
16	Juglans DBF	0.830	0.831
17	Larix DCF	0.697	0.716
18	Miscanthus Herb	0.624	0.637
19	Open space Herb	0.880	0.896
20	Paddy field	0.786	0.799
21	Pasture	0.805	0.813
22	Pinus ECF	0.865	0.892
23	Pinus Shrub	0.880	0.880
24	Populus DBF	0.823	0.823
25	Pterocarya DBF	0.810	0.816
26	Quercus DBF	0.720	0.752
27	Quercus Shrub	0.727	0.728
28	Robinia DBF	0.804	0.814
29	Salix DBF	0.815	0.820
30	Salix Shrub	0.813	0.816
31	Sasa Shrub	0.717	0.722
32	Thujopsis ECF	0.917	0.917
33	Tilia DBF	0.792	0.794
34	Upland field	0.599	0.623
35	Water	0.874	0.882
36	Weigela Shrub	0.728	0.741
37	Wetland Herb	0.866	0.877
38	Zelkova DBF	0.653	0.659
39	Zoysia Herb	0.897	0.897

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.3. Aomori prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.751	0.769
2	Abies ECF	0.924	0.927
3	Alnus DBF	0.788	0.797
4	Alpine Herb	0.642	0.643
5	Alpine Shrub	0.758	0.758
6	Barren	0.810	0.828
7	Betula DBF	0.795	0.799
8	Builtup	0.633	0.652
9	Carpinus DBF	0.908	0.908
10	Coastal Herb	0.799	0.800
11	Costal Shrub	0.607	0.607
12	Cryptomeria-Chamaecyparis ECF	0.839	0.862
13	Deciduous Shrub	0.744	0.744
14	Fagus DBF	0.585	0.604
15	Fraxinus DBF	0.612	0.615
16	Hydrangea Shrub	0.806	0.823
17	Juglans DBF	0.880	0.886
18	Larix DCF	0.685	0.699
19	Miscanthus Herb	0.814	0.834
20	Open space Herb	0.833	0.851
21	Paddy field	0.691	0.705
22	Pasture	0.722	0.735
23	Pinus ECF	0.862	0.883
24	Pinus Shrub	0.915	0.915
25	Pterocarya DBF	0.615	0.633
26	Quercus DBF	0.662	0.688
27	Quercus Shrub	0.808	0.810
28	Robinia DBF	0.761	0.766
29	Salix DBF	0.825	0.837
30	Salix Shrub	0.716	0.720
31	Sasa Shrub	0.744	0.752
32	Thujopsis ECF	0.712	0.727
33	Tilia DBF	0.762	0.766
34	Ulmus DBF	0.738	0.738
35	Upland field	0.822	0.844
36	Water	0.903	0.907
37	Weigela Shrub	0.738	0.739
38	Wetland Herb	0.608	0.626
39	Zelkova DBF	0.676	0.679
40	Zoysia Herb	0.848	0.848

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.4. Chiba prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.626	0.653
2	Abies ECF	0.892	0.898
3	Bamboo EBF	0.785	0.827
4	Barren	0.778	0.814
5	Builtup	0.850	0.893
6	Castanopsis EBF	0.563	0.569
7	Coastal Herb	0.792	0.794
8	Cryptomeria-Chamaecyparis ECF	0.772	0.814
9	Deciduous Shrub	0.544	0.548
10	Euptelea DBF	0.717	0.718
11	Lithocarpus EBF	0.660	0.673
12	Machilus EBF	0.733	0.733
13	Miscanthus Herb	0.620	0.640
14	Open space Herb	0.804	0.837
15	Paddy field	0.700	0.724
16	Pasture	0.826	0.831
17	Pinus ECF	0.882	0.892
18	Quercus DBF	0.675	0.722
19	Quercus EBF	0.685	0.729
20	Salix DBF	0.543	0.545
21	Salix Shrub	0.576	0.577
22	Sasa Shrub	0.572	0.577
23	Upland field	0.830	0.865
24	Water	0.784	0.800
25	Wetland Herb	0.746	0.762

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.5. Ehime prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.558	0.564
2	Abies ECF	0.720	0.726
3	Alpine Herb	0.500	0.500
4	Alpine Shrub	0.702	0.703
5	Bamboo EBF	0.582	0.605
6	Barren	0.685	0.697
7	Betula DBF	0.790	0.791
8	Builtup	0.663	0.691
9	Carpinus DBF	0.617	0.645
10	Castanopsis EBF	0.693	0.694
11	Celtis DBF	0.729	0.763
12	Coastal Herb	0.603	0.603
13	Cornus DBF	0.642	0.654
14	Cryptomeria-Chamaecyparis ECF	0.569	0.605
15	Deciduous Shrub	0.834	0.836
16	Fagus DBF	0.676	0.685
17	Larix DCF	0.685	0.687
18	Machilus EBF	0.841	0.842
19	Mallotus DBF	0.615	0.633
20	Miscanthus Herb	0.624	0.629
21	Open space Herb	0.727	0.752
22	Paddy field	0.696	0.718
23	Pasture	0.576	0.579
24	Pinus ECF	0.821	0.858
25	Pterocarya DBF	0.730	0.732
26	Quercus DBF	0.570	0.606
27	Quercus EBF	0.588	0.618
28	Sasa Shrub	0.684	0.685
29	Tsuga ECF	0.856	0.866
30	Upland field	0.763	0.805
31	Water	0.708	0.715
32	Wetland Herb	0.694	0.703
33	Zelkova DBF	0.703	0.711

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.6. Fukui prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.562	0.566
2	Abies ECF	0.728	0.729
3	Alnus DBF	0.694	0.694
4	Alnus Shrub	0.857	0.861
5	Alpine Shrub	0.849	0.850
6	Bamboo EBF	0.729	0.741
7	Barren	0.666	0.679
8	Betula DBF	0.760	0.760
9	Builtup	0.741	0.764
10	Carpinus DBF	0.817	0.833
11	Castanopsis EBF	0.696	0.700
12	Coastal Herb	0.631	0.632
13	Cryptomeria-Chamaecyparis ECF	0.851	0.891
14	Deciduous Shrub	0.806	0.837
15	Fagus DBF	0.631	0.661
16	Hydrangea Shrub	0.816	0.816
17	Juglans DBF	0.595	0.596
18	Larix DCF	0.634	0.634
19	Machilus EBF	0.736	0.737
20	Mallotus DBF	0.641	0.643
21	Miscanthus Herb	0.646	0.657
22	Open space Herb	0.759	0.780
23	Paddy field	0.770	0.789
24	Pasture	0.870	0.873
25	Pinus ECF	0.817	0.855
26	Pterocarya DBF	0.746	0.752
27	Quercus DBF	0.592	0.634
28	Quercus EBF	0.813	0.826
29	Salix DBF	0.713	0.715
30	Salix Shrub	0.679	0.682
31	Sasa Shrub	0.606	0.610
32	Thuja ECF	0.816	0.817
33	Upland field	0.629	0.648
34	Water	0.798	0.809
35	Weigela Shrub	0.748	0.750
36	Wetland Herb	0.821	0.837
37	Zelkova DBF	0.869	0.895

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.7. Fukuoka prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.479	0.487
2	Bamboo EBF	0.817	0.854
3	Barren	0.694	0.728
4	Builtup	0.564	0.601
5	Carpinus DBF	0.610	0.620
6	Carpinus Shrub	0.662	0.662
7	Castanopsis EBF	0.636	0.641
8	Coastal Herb	0.692	0.692
9	Cryptomeria-Chamaecyparis ECF	0.808	0.848
10	Fagus DBF	0.882	0.882
11	Lithocarpus EBF	0.640	0.643
12	Litsea EBF	0.667	0.668
13	Machilus EBF	0.729	0.738
14	Mallotus DBF	0.676	0.714
15	Miscanthus Herb	0.774	0.793
16	Open space Herb	0.693	0.730
17	Paddy field	0.684	0.707
18	Pasture	0.731	0.740
19	Pinus ECF	0.740	0.773
20	Quercus DBF	0.686	0.730
21	Quercus EBF	0.641	0.681
22	Salix DBF	0.833	0.833
23	Salix Shrub	0.753	0.753
24	Sasa Shrub	0.600	0.600
25	Upland field	0.765	0.805
26	Water	0.696	0.716
27	Wetland Herb	0.622	0.637
28	Zelkova DBF	0.676	0.677

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.8. Fukushima prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.766	0.786
2	Abies ECF	0.786	0.795
3	Acer Shrub	0.901	0.901
4	Alnus DBF	0.602	0.604
5	Alnus Shrub	0.695	0.707
6	Alpine Herb	0.779	0.782
7	Alpine Shrub	0.808	0.809
8	Bamboo EBF	0.861	0.867
9	Barren	0.815	0.832
10	Betula DBF	0.752	0.758
11	Builtup	0.619	0.636
12	Carpinus DBF	0.642	0.645
13	Cryptomeria-Chamaecyparis ECF	0.627	0.642
14	Deciduous Shrub	0.720	0.726
15	Fagus DBF	0.823	0.842
16	Fraxinus DBF	0.620	0.620
17	Hydrangea Shrub	0.888	0.899
18	Juglans DBF	0.872	0.884
19	Larix DCF	0.714	0.725
20	Machilus EBF	0.831	0.832
21	Mallotus DBF	0.771	0.773
22	Miscanthus Herb	0.597	0.619
23	Open space Herb	0.847	0.864
24	Paddy field	0.708	0.720
25	Pasture	0.701	0.708
26	Pinus ECF	0.855	0.873
27	Pinus Shrub	0.901	0.901
28	Pterocarya DBF	0.627	0.635
29	Quercus DBF	0.623	0.646
30	Quercus EBF	0.862	0.863
31	Quercus Shrub	0.688	0.700
32	Rhododendron Shrub	0.875	0.875
33	Robinia DBF	0.686	0.689
34	Salix DBF	0.819	0.826
35	Salix Shrub	0.676	0.678
36	Sasa Shrub	0.684	0.691
37	Thuja ECF	0.657	0.668
38	Thujopsis ECF	0.863	0.864
39	Tsuga ECF	0.794	0.795
40	Ulmus DBF	0.866	0.866
41	Upland field	0.776	0.797
42	Water	0.850	0.856
43	Weigela Shrub	0.640	0.652
44	Wetland Herb	0.804	0.816
45	Zelkova DBF	0.629	0.640

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.9. Gifu prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.656	0.669
2	Abies ECF	0.716	0.729
3	Acer DBF	0.894	0.894
4	Alnus DBF	0.740	0.743
5	Alnus Shrub	0.868	0.872
6	Alpine Herb	0.728	0.731
7	Alpine Shrub	0.622	0.624
8	Bamboo EBF	0.877	0.885
9	Barren	0.801	0.820
10	Betula DBF	0.660	0.676
11	Builtup	0.633	0.652
12	Carpinus DBF	0.659	0.676
13	Castanopsis EBF	0.702	0.702
14	Celtis DBF	0.753	0.754
15	Cryptomeria-Chamaecyparis ECF	0.606	0.626
16	Deciduous Shrub	0.628	0.640
17	Fagus DBF	0.637	0.654
18	Fraxinus DBF	0.866	0.867
19	Hydrangea Shrub	0.887	0.890
20	Juglans DBF	0.659	0.661
21	Larix DCF	0.785	0.795
22	Mallotus DBF	0.724	0.727
23	Miscanthus Herb	0.759	0.769
24	Open space Herb	0.593	0.610
25	Paddy field	0.656	0.672
26	Pasture	0.673	0.681
27	Pinus ECF	0.623	0.642
28	Pinus Shrub	0.863	0.864
29	Populus DBF	0.702	0.703
30	Pterocarya DBF	0.808	0.820
31	Quercus DBF	0.584	0.608
32	Quercus EBF	0.784	0.788
33	Rhododendron Shrub	0.728	0.729
34	Salix DBF	0.764	0.767
35	Salix Shrub	0.715	0.719
36	Sasa Shrub	0.695	0.704
37	Sciadopitys ECF	0.797	0.797
38	Thuja ECF	0.619	0.623
39	Tsuga ECF	0.655	0.664
40	Upland field	0.770	0.793
41	Water	0.765	0.776
42	Weigela Shrub	0.899	0.900
43	Wetland Herb	0.667	0.675
44	Zelkova DBF	0.596	0.614

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.10. Gunma prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.642	0.650
2	Abies ECF	0.727	0.743
3	Acer Shrub	0.782	0.783
4	Alnus DBF	0.805	0.807
5	Alnus Shrub	0.756	0.760
6	Alpine Herb	0.735	0.736
7	Alpine Shrub	0.775	0.776
8	Bamboo EBF	0.686	0.691
9	Barren	0.661	0.677
10	Betula DBF	0.592	0.613
11	Builtup	0.640	0.663
12	Carpinus DBF	0.818	0.820
13	Cryptomeria-Chamaecyparis ECF	0.614	0.637
14	Deciduous Shrub	0.738	0.742
15	Euptelea DBF	0.592	0.592
16	Fagus DBF	0.611	0.632
17	Fraxinus DBF	0.867	0.868
18	Hydrangea Shrub	0.840	0.841
19	Larix DCF	0.634	0.654
20	Mallotus DBF	0.618	0.621
21	Miscanthus Herb	0.790	0.802
22	Open space Herb	0.661	0.679
23	Paddy field	0.690	0.707
24	Pasture	0.687	0.692
25	Pinus ECF	0.833	0.858
26	Pinus Shrub	0.818	0.819
27	Pterocarya DBF	0.737	0.740
28	Quercus DBF	0.650	0.681
29	Quercus EBF	0.526	0.526
30	Quercus Shrub	0.643	0.652
31	Robinia DBF	0.670	0.676
32	Salix DBF	0.723	0.724
33	Salix Shrub	0.624	0.625
34	Sasa Shrub	0.644	0.655
35	Thuja ECF	0.886	0.900
36	Thujopsis ECF	0.692	0.695
37	Tsuga ECF	0.639	0.649
38	Ulmus DBF	0.634	0.635
39	Upland field	0.812	0.838
40	Water	0.726	0.738
41	Weigela Shrub	0.621	0.630
42	Wetland Herb	0.882	0.888
43	Zelkova DBF	0.736	0.744

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.11. Hiroshima prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.635	0.678
2	Abies ECF	0.782	0.783
3	Alnus DBF	0.706	0.706
4	Bamboo EBF	0.645	0.671
5	Barren	0.706	0.727
6	Builtup	0.589	0.620
7	Carpinus DBF	0.636	0.638
8	Castanopsis EBF	0.668	0.669
9	Celtis DBF	0.734	0.750
10	Cryptomeria-Chamaecyparis ECF	0.651	0.676
11	Deciduous Shrub	0.655	0.656
12	Fagus DBF	0.845	0.846
13	Hydrangea Shrub	0.816	0.821
14	Larix DCF	0.784	0.786
15	Lithocarpus EBF	0.726	0.726
16	Machilus EBF	0.677	0.677
17	Mallotus DBF	0.677	0.714
18	Miscanthus Herb	0.741	0.748
19	Open space Herb	0.850	0.877
20	Paddy field	0.605	0.632
21	Pasture	0.702	0.713
22	Pinus ECF	0.823	0.858
23	Pterocarya DBF	0.892	0.893
24	Quercus DBF	0.695	0.734
25	Quercus EBF	0.636	0.650
26	Salix DBF	0.725	0.726
27	Salix Shrub	0.648	0.650
28	Sasa Shrub	0.818	0.819
29	Tsuga ECF	0.876	0.876
30	Upland field	0.674	0.716
31	Water	0.727	0.745
32	Wetland Herb	0.661	0.679
33	Zelkova DBF	0.603	0.612

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.12. HokkaidoA prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.656	0.665
2	Abies ECF	0.605	0.619
3	Alnus DBF	0.845	0.859
4	Alnus Shrub	0.761	0.769
5	Alpine Herb	0.865	0.868
6	Alpine Shrub	0.757	0.759
7	Barren	0.830	0.845
8	Betula DBF	0.879	0.892
9	Builtup	0.686	0.697
10	Cercidiphyllum DBF	0.685	0.688
11	Coastal Herb	0.799	0.800
12	Costal Shrub	0.839	0.839
13	Cryptomeria-Chamaecyparis ECF	0.895	0.899
14	Deciduous Shrub	0.643	0.646
15	Fagus DBF	0.879	0.883
16	Fraxinus DBF	0.652	0.663
17	Juglans DBF	0.639	0.640
18	Larix DCF	0.630	0.642
19	Miscanthus Herb	0.636	0.648
20	Open space Herb	0.648	0.667
21	Paddy field	0.781	0.788
22	Pasture	0.686	0.697
23	Picea ECF	0.641	0.652
24	Pinus ECF	0.828	0.833
25	Pinus Shrub	0.930	0.932
26	Populus DBF	0.680	0.684
27	Pterocarya DBF	0.651	0.653
28	Quercus DBF	0.682	0.701
29	Quercus Shrub	0.874	0.875
30	Robinia DBF	0.685	0.692
31	Salix DBF	0.678	0.698
32	Salix Shrub	0.817	0.832
33	Sasa Shrub	0.873	0.887
34	Tilia DBF	0.914	0.915
35	Ulmus DBF	0.743	0.762
36	Upland field	0.609	0.621
37	Water	0.815	0.821
38	Weigela Shrub	0.822	0.828
39	Wetland Herb	0.667	0.677

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.13. HokkaidoB prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.673	0.678
2	Abies ECF	0.845	0.864
3	Alnus DBF	0.844	0.860
4	Alnus Shrub	0.811	0.818
5	Alpine Herb	0.966	0.966
6	Alpine Shrub	0.935	0.936
7	Barren	0.592	0.607
8	Betula DBF	0.824	0.841
9	Builtup	0.694	0.707
10	Cercidiphyllum DBF	0.849	0.850
11	Coastal Herb	0.793	0.795
12	Costal Shrub	0.825	0.826
13	Deciduous Shrub	0.635	0.650
14	Fraxinus DBF	0.828	0.847
15	Juglans DBF	0.724	0.724
16	Larix DCF	0.622	0.637
17	Miscanthus Herb	0.794	0.795
18	Open space Herb	0.682	0.704
19	Paddy field	0.893	0.897
20	Pasture	0.693	0.705
21	Picea ECF	0.596	0.612
22	Pinus ECF	0.759	0.762
23	Pinus Shrub	0.934	0.937
24	Populus DBF	0.719	0.730
25	Quercus DBF	0.711	0.733
26	Quercus Shrub	0.830	0.830
27	Robinia DBF	0.875	0.875
28	Salix DBF	0.732	0.754
29	Salix Shrub	0.820	0.830
30	Sasa Shrub	0.589	0.605
31	Tilia DBF	0.887	0.888
32	Ulmus DBF	0.717	0.740
33	Upland field	0.726	0.737
34	Water	0.890	0.895
35	Weigela Shrub	0.848	0.850
36	Wetland Herb	0.706	0.717

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.14. Hyogo prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.628	0.649
2	Abies ECF	0.737	0.741
3	Alnus DBF	0.781	0.781
4	Bamboo EBF	0.856	0.887
5	Barren	0.689	0.724
6	Builtup	0.583	0.615
7	Carpinus DBF	0.744	0.753
8	Castanopsis EBF	0.650	0.655
9	Celtis DBF	0.793	0.794
10	Coastal Herb	0.737	0.737
11	Cryptomeria-Chamaecyparis ECF	0.623	0.649
12	Deciduous Shrub	0.613	0.614
13	Euptelea DBF	0.733	0.733
14	Fagus DBF	0.724	0.729
15	Hydrangea Shrub	0.759	0.761
16	Juglans DBF	0.834	0.834
17	Larix DCF	0.729	0.730
18	Machilus EBF	0.618	0.618
19	Mallotus DBF	0.529	0.552
20	Miscanthus Herb	0.795	0.805
21	Open space Herb	0.795	0.822
22	Paddy field	0.613	0.639
23	Pasture	0.629	0.638
24	Pinus ECF	0.823	0.857
25	Pterocarya DBF	0.792	0.796
26	Pterostyrax DBF	0.612	0.612
27	Quercus DBF	0.624	0.662
28	Quercus EBF	0.675	0.698
29	Salix DBF	0.599	0.600
30	Salix Shrub	0.684	0.685
31	Sasa Shrub	0.708	0.709
32	Tsuga ECF	0.793	0.793
33	Upland field	0.630	0.668
34	Water	0.667	0.690
35	Wetland Herb	0.715	0.742
36	Zelkova DBF	0.816	0.835

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.15. Ibaraki prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.549	0.578
2	Abies ECF	0.599	0.601
3	Alnus DBF	0.739	0.739
4	Alpine Herb	0.768	0.768
5	Bamboo EBF	0.732	0.752
6	Barren	0.619	0.658
7	Builtup	0.806	0.850
8	Carpinus DBF	0.780	0.786
9	Castanopsis EBF	0.600	0.608
10	Coastal Herb	0.631	0.631
11	Cryptomeria-Chamaecyparis ECF	0.599	0.627
12	Deciduous Shrub	0.572	0.593
13	Fagus DBF	0.649	0.650
14	Juglans DBF	0.551	0.552
15	Machilus EBF	0.606	0.609
16	Mallotus DBF	0.685	0.698
17	Miscanthus Herb	0.482	0.510
18	Open space Herb	0.734	0.769
19	Paddy field	0.733	0.753
20	Pasture	0.584	0.604
21	Pinus ECF	0.809	0.841
22	Quercus DBF	0.640	0.675
23	Quercus EBF	0.692	0.722
24	Salix DBF	0.513	0.514
25	Salix Shrub	0.554	0.559
26	Upland field	0.779	0.817
27	Water	0.903	0.910
28	Wetland Herb	0.760	0.787
29	Zelkova DBF	0.726	0.734

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.16. Ishikawa prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.610	0.619
2	Abies ECF	0.687	0.691
3	Alnus Shrub	0.608	0.619
4	Alpine Herb	0.839	0.841
5	Alpine Shrub	0.798	0.800
6	Bamboo EBF	0.637	0.651
7	Barren	0.714	0.734
8	Betula DBF	0.739	0.745
9	Builtup	0.695	0.719
10	Castanopsis EBF	0.726	0.728
11	Coastal Herb	0.799	0.801
12	Cornus DBF	0.694	0.696
13	Costal Shrub	0.740	0.740
14	Cryptomeria-Chamaecyparis ECF	0.789	0.829
15	Deciduous Shrub	0.681	0.715
16	Fagus DBF	0.773	0.790
17	Juglans DBF	0.614	0.622
18	Machilus EBF	0.735	0.735
19	Miscanthus Herb	0.677	0.692
20	Open space Herb	0.804	0.828
21	Paddy field	0.706	0.727
22	Pasture	0.656	0.661
23	Pinus ECF	0.775	0.812
24	Pinus Shrub	0.720	0.720
25	Pterocarya DBF	0.827	0.828
26	Quercus DBF	0.653	0.690
27	Robinia DBF	0.781	0.786
28	Salix DBF	0.824	0.825
29	Salix Shrub	0.715	0.715
30	Sasa Shrub	0.650	0.653
31	Thuja ECF	0.789	0.793
32	Upland field	0.819	0.854
33	Water	0.745	0.755
34	Wetland Herb	0.680	0.685
35	Zelkova DBF	0.848	0.882

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.17. Iwate prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.729	0.754
2	Abies ECF	0.915	0.918
3	Alnus DBF	0.800	0.808
4	Alnus Shrub	0.789	0.789
5	Alpine Herb	0.846	0.847
6	Alpine Shrub	0.812	0.813
7	Bamboo EBF	0.674	0.675
8	Barren	0.864	0.878
9	Betula DBF	0.758	0.768
10	Builtup	0.583	0.602
11	Carpinus DBF	0.727	0.729
12	Cryptomeria-Chamaecyparis ECF	0.637	0.653
13	Deciduous Shrub	0.766	0.767
14	Fagus DBF	0.668	0.682
15	Fraxinus DBF	0.778	0.778
16	Hydrangea Shrub	0.853	0.857
17	Juglans DBF	0.669	0.686
18	Larix DCF	0.657	0.671
19	Miscanthus Herb	0.794	0.814
20	Open space Herb	0.760	0.781
21	Paddy field	0.678	0.692
22	Pasture	0.632	0.648
23	Pinus ECF	0.605	0.622
24	Pinus Shrub	0.892	0.893
25	Pterocarya DBF	0.605	0.622
26	Quercus DBF	0.673	0.696
27	Quercus Shrub	0.860	0.861
28	Rhododendron Shrub	0.822	0.822
29	Robinia DBF	0.778	0.781
30	Salix DBF	0.818	0.831
31	Salix Shrub	0.696	0.700
32	Sasa Shrub	0.683	0.692
33	Thujopsis ECF	0.878	0.882
34	Tsuga ECF	0.906	0.907
35	Ulmus DBF	0.793	0.794
36	Upland field	0.709	0.733
37	Water	0.747	0.758
38	Weigela Shrub	0.811	0.817
39	Wetland Herb	0.790	0.801
40	Zelkova DBF	0.635	0.648
41	Zoysia Herb	0.704	0.704

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.18. Kagawa prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.509	0.519
2	Bamboo EBF	0.794	0.829
3	Barren	0.608	0.632
4	Builtup	0.605	0.648
5	Carpinus DBF	0.658	0.658
6	Carpinus Shrub	0.766	0.767
7	Castanopsis EBF	0.783	0.784
8	Celtis DBF	0.690	0.716
9	Cryptomeria-Chamaecyparis ECF	0.564	0.611
10	Deciduous Shrub	0.648	0.669
11	Mallotus DBF	0.603	0.604
12	Miscanthus Herb	0.671	0.673
13	Open space Herb	0.805	0.826
14	Paddy field	0.584	0.625
15	Pasture	0.801	0.803
16	Pinus ECF	0.657	0.713
17	Quercus DBF	0.652	0.709
18	Quercus EBF	0.851	0.878
19	Robinia DBF	0.780	0.781
20	Upland field	0.711	0.766
21	Water	0.804	0.817
22	Wetland Herb	0.709	0.722
23	Zelkova DBF	0.814	0.814

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.19. Kagoshima prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.497	0.517
2	Abies ECF	0.825	0.827
3	Alpine Herb	0.866	0.869
4	Alpine Shrub	0.699	0.699
5	Ardisia EBF	0.698	0.698
6	Bamboo EBF	0.856	0.879
7	Bamboo Shrub	0.668	0.677
8	Barren	0.647	0.669
9	Builtup	0.819	0.847
10	Castanopsis EBF	0.822	0.845
11	Celtis DBF	0.677	0.677
12	Coastal Herb	0.589	0.592
13	Cornus DBF	0.639	0.644
14	Costal Shrub	0.628	0.628
15	Cryptomeria-Chamaecyparis ECF	0.722	0.752
16	Deciduous Shrub	0.670	0.673
17	Fagus DBF	0.796	0.797
18	Hibiscus EBF	0.744	0.744
19	Juniperus Shrub	0.656	0.656
20	Lagestroemia DBF	0.900	0.900
21	Lithocarpus EBF	0.635	0.654
22	Litsea EBF	0.803	0.810
23	Machilus EBF	0.760	0.786
24	Mallotus DBF	0.586	0.616
25	Mangroves EBF	0.761	0.761
26	Miscanthus Herb	0.587	0.598
27	Open space Herb	0.692	0.716
28	Paddy field	0.616	0.633
29	Palm ECF	0.857	0.858
30	Pandanus ECF	0.641	0.642
31	Pasture	0.787	0.799
32	Pinus ECF	0.745	0.768
33	Pongamia EBF	0.657	0.660
34	Quercus DBF	0.795	0.811
35	Quercus EBF	0.617	0.647
36	Rhododendron Shrub	0.607	0.608
37	Salix DBF	0.465	0.465
38	Salix Shrub	0.628	0.628
39	Sasa Shrub	0.683	0.686
40	Schima EBF	0.760	0.766
41	Stewartia DBF	0.859	0.863
42	Treefern ECF	0.762	0.763
43	Trema EBF	0.841	0.861
44	Tsuga ECF	0.849	0.853
45	Upland field	0.827	0.849

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

46	Water	0.763	0.772
47	Weigela Shrub	0.829	0.829
48	Wetland Herb	0.595	0.607
49	Zelkova DBF	0.606	0.607
50	Zoysia Herb	0.793	0.794

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.20. Kanagawa prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.436	0.439
2	Abies ECF	0.722	0.732
3	Alnus DBF	0.542	0.543
4	Alpine Herb	0.729	0.729
5	Alpine Shrub	0.633	0.643
6	Bamboo EBF	0.601	0.616
7	Barren	0.617	0.637
8	Builtup	0.612	0.654
9	Carpinus DBF	0.767	0.808
10	Castanopsis EBF	0.526	0.528
11	Celtis DBF	0.454	0.455
12	Coastal Herb	0.575	0.577
13	Cryptomeria-Chamaecyparis ECF	0.615	0.649
14	Deciduous Shrub	0.532	0.540
15	Euptelea DBF	0.457	0.459
16	Fagus DBF	0.745	0.763
17	Fraxinus DBF	0.714	0.715
18	Hydrangea Shrub	0.717	0.718
19	Larix DCF	0.839	0.840
20	Lithocarpus EBF	0.611	0.614
21	Machilus EBF	0.417	0.419
22	Mallotus DBF	0.758	0.772
23	Miscanthus Herb	0.614	0.626
24	Open space Herb	0.848	0.880
25	Paddy field	0.718	0.742
26	Pasture	0.520	0.526
27	Pinus ECF	0.724	0.735
28	Prunus DBF	0.646	0.647
29	Quercus DBF	0.584	0.622
30	Quercus EBF	0.570	0.588
31	Robinia DBF	0.597	0.598
32	Salix Shrub	0.800	0.800
33	Sasa Shrub	0.769	0.773
34	Tsuga ECF	0.679	0.684
35	Upland field	0.766	0.812
36	Water	0.734	0.744
37	Wetland Herb	0.473	0.478
38	Zelkova DBF	0.573	0.583

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.21. Kochi prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.544	0.559
2	Abies ECF	0.805	0.821
3	Bamboo EBF	0.627	0.649
4	Barren	0.647	0.663
5	Betula DBF	0.883	0.883
6	Builtup	0.617	0.651
7	Carpinus DBF	0.729	0.768
8	Carpinus Shrub	0.635	0.635
9	Castanopsis EBF	0.678	0.680
10	Celtis DBF	0.743	0.744
11	Coastal Herb	0.745	0.746
12	Cornus DBF	0.592	0.594
13	Cryptomeria-Chamaecyparis ECF	0.817	0.857
14	Deciduous Shrub	0.804	0.812
15	Elaeocarpus EBF	0.914	0.914
16	Fagus DBF	0.614	0.622
17	Hydrangea Shrub	0.816	0.821
18	Machilus EBF	0.742	0.745
19	Mallotus DBF	0.616	0.637
20	Miscanthus Herb	0.712	0.717
21	Open space Herb	0.687	0.706
22	Paddy field	0.588	0.620
23	Pasture	0.661	0.666
24	Pinus ECF	0.783	0.809
25	Pterocarya DBF	0.777	0.778
26	Quercus DBF	0.696	0.735
27	Quercus EBF	0.778	0.815
28	Rhododendron Shrub	0.708	0.708
29	Salix DBF	0.718	0.719
30	Salix Shrub	0.789	0.789
31	Sasa Shrub	0.709	0.712
32	Tsuga ECF	0.723	0.732
33	Upland field	0.706	0.747
34	Water	0.748	0.760
35	Wetland Herb	0.717	0.726
36	Zelkova DBF	0.612	0.625

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.22. Kumamoto prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.558	0.575
2	Abies ECF	0.687	0.690
3	Alnus DBF	0.780	0.784
4	Alpine Herb	0.929	0.929
5	Bamboo EBF	0.601	0.631
6	Bamboo Shrub	0.871	0.871
7	Barren	0.712	0.730
8	Builtup	0.637	0.665
9	Carpinus DBF	0.889	0.892
10	Castanopsis EBF	0.613	0.614
11	Cornus DBF	0.779	0.790
12	Cryptomeria-Chamaecyparis ECF	0.825	0.860
13	Deciduous Shrub	0.769	0.772
14	Fagus DBF	0.790	0.793
15	Hydrangea Shrub	0.819	0.823
16	Machilus EBF	0.683	0.684
17	Mallotus DBF	0.715	0.752
18	Miscanthus Herb	0.651	0.674
19	Open space Herb	0.805	0.830
20	Paddy field	0.660	0.683
21	Pasture	0.653	0.668
22	Pinus ECF	0.830	0.841
23	Quercus DBF	0.742	0.777
24	Quercus EBF	0.795	0.829
25	Rhododendron Shrub	0.834	0.836
26	Salix DBF	0.686	0.686
27	Sasa Shrub	0.825	0.825
28	Tsuga ECF	0.870	0.870
29	Upland field	0.752	0.788
30	Water	0.720	0.731
31	Weigela Shrub	0.800	0.802
32	Wetland Herb	0.732	0.745
33	Zelkova DBF	0.790	0.800
34	Zoysia Herb	0.765	0.765

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.23. Kyoto prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.622	0.631
2	Abies ECF	0.794	0.797
3	Alnus DBF	0.900	0.900
4	Bamboo EBF	0.638	0.668
5	Barren	0.753	0.767
6	Builtup	0.692	0.720
7	Carpinus DBF	0.716	0.731
8	Castanopsis EBF	0.766	0.774
9	Coastal Herb	0.762	0.762
10	Cryptomeria-Chamaecyparis ECF	0.818	0.861
11	Fagus DBF	0.800	0.806
12	Machilus EBF	0.648	0.650
13	Mallotus DBF	0.591	0.594
14	Miscanthus Herb	0.702	0.713
15	Open space Herb	0.766	0.803
16	Paddy field	0.678	0.705
17	Pasture	0.710	0.715
18	Pinus ECF	0.760	0.806
19	Pterocarya DBF	0.823	0.825
20	Quercus DBF	0.645	0.693
21	Quercus EBF	0.599	0.615
22	Salix DBF	0.690	0.692
23	Sasa Shrub	0.900	0.900
24	Upland field	0.839	0.877
25	Water	0.722	0.736
26	Wetland Herb	0.742	0.753
27	Zelkova DBF	0.746	0.763

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.24. Mie prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.556	0.575
2	Abies ECF	0.891	0.898
3	Alnus DBF	0.551	0.553
4	Alpine Shrub	0.808	0.809
5	Bamboo EBF	0.813	0.847
6	Barren	0.657	0.691
7	Builtup	0.588	0.620
8	Carpinus DBF	0.659	0.682
9	Castanopsis EBF	0.689	0.694
10	Coastal Herb	0.647	0.648
11	Cryptomeria-Chamaecyparis ECF	0.611	0.641
12	Deciduous Shrub	0.652	0.652
13	Fagus DBF	0.638	0.641
14	Juglans DBF	0.876	0.876
15	Machilus EBF	0.695	0.698
16	Mallotus DBF	0.574	0.589
17	Miscanthus Herb	0.688	0.697
18	Open space Herb	0.787	0.818
19	Paddy field	0.688	0.709
20	Pasture	0.606	0.608
21	Pinus ECF	0.713	0.752
22	Pterocarya DBF	0.875	0.876
23	Quercus DBF	0.646	0.682
24	Quercus EBF	0.846	0.876
25	Salix DBF	0.643	0.644
26	Salix Shrub	0.608	0.608
27	Sasa Shrub	0.865	0.865
28	Tsuga ECF	0.601	0.609
29	Upland field	0.784	0.819
30	Water	0.662	0.684
31	Wetland Herb	0.621	0.640
32	Zelkova DBF	0.741	0.754

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.25. Miyagi prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.765	0.791
2	Abies ECF	0.887	0.892
3	Acer Shrub	0.816	0.816
4	Alnus DBF	0.719	0.719
5	Alnus Shrub	0.849	0.849
6	Alpine Herb	0.761	0.761
7	Alpine Shrub	0.781	0.781
8	Bamboo EBF	0.851	0.860
9	Barren	0.778	0.803
10	Betula DBF	0.879	0.879
11	Builtup	0.873	0.900
12	Carpinus DBF	0.652	0.654
13	Coastal Herb	0.844	0.844
14	Cryptomeria-Chamaecyparis ECF	0.629	0.651
15	Deciduous Shrub	0.857	0.857
16	Fagus DBF	0.732	0.747
17	Fraxinus DBF	0.823	0.823
18	Hydrangea Shrub	0.628	0.638
19	Juglans DBF	0.632	0.638
20	Larix DCF	0.790	0.802
21	Machilus EBF	0.763	0.763
22	Mallotus DBF	0.522	0.522
23	Miscanthus Herb	0.723	0.753
24	Open space Herb	0.792	0.818
25	Paddy field	0.714	0.730
26	Pasture	0.647	0.668
27	Pinus ECF	0.861	0.885
28	Pinus Shrub	0.667	0.667
29	Pterocarya DBF	0.886	0.895
30	Quercus DBF	0.718	0.748
31	Quercus Shrub	0.838	0.838
32	Robinia DBF	0.714	0.716
33	Salix DBF	0.777	0.788
34	Salix Shrub	0.685	0.692
35	Sasa Shrub	0.845	0.847
36	Ulmus DBF	0.753	0.754
37	Upland field	0.691	0.724
38	Water	0.764	0.777
39	Weigela Shrub	0.687	0.690
40	Wetland Herb	0.837	0.855
41	Zelkova DBF	0.837	0.847

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.26. Miyazaki prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.504	0.519
2	Abies ECF	0.664	0.677
3	Acer DBF	0.663	0.664
4	Alpine Herb	0.659	0.659
5	Alpine Shrub	0.796	0.796
6	Bamboo EBF	0.773	0.800
7	Bamboo Shrub	0.485	0.486
8	Barren	0.579	0.598
9	Builtup	0.625	0.650
10	Carpinus DBF	0.612	0.635
11	Castanopsis EBF	0.603	0.620
12	Celtis DBF	0.465	0.465
13	Coastal Herb	0.687	0.689
14	Cornus DBF	0.867	0.874
15	Cryptomeria-Chamaecyparis ECF	0.727	0.761
16	Deciduous Shrub	0.711	0.723
17	Euptelea DBF	0.556	0.557
18	Fagus DBF	0.712	0.719
19	Lithocarpus EBF	0.666	0.668
20	Machilus EBF	0.836	0.847
21	Mallotus DBF	0.548	0.579
22	Miscanthus Herb	0.612	0.632
23	Open space Herb	0.711	0.735
24	Paddy field	0.659	0.679
25	Pasture	0.743	0.756
26	Pinus ECF	0.730	0.759
27	Pterocarya DBF	0.617	0.618
28	Quercus DBF	0.708	0.743
29	Quercus EBF	0.538	0.571
30	Rhododendron Shrub	0.786	0.786
31	Salix DBF	0.454	0.455
32	Salix Shrub	0.539	0.540
33	Sasa Shrub	0.822	0.822
34	Stewartia DBF	0.630	0.631
35	Tsuga ECF	0.784	0.793
36	Upland field	0.819	0.845
37	Water	0.711	0.725
38	Wetland Herb	0.651	0.670
39	Zelkova DBF	0.580	0.582
40	Zoysia Herb	0.838	0.838

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.27. Nagano prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.685	0.702
2	Abies ECF	0.667	0.681
3	Acer Shrub	0.731	0.732
4	Alnus DBF	0.816	0.823
5	Alnus Shrub	0.794	0.794
6	Alpine Herb	0.734	0.740
7	Alpine Shrub	0.899	0.900
8	Bamboo EBF	0.887	0.891
9	Barren	0.807	0.825
10	Betula DBF	0.770	0.789
11	Builtup	0.639	0.654
12	Carpinus DBF	0.637	0.648
13	Cornus DBF	0.710	0.710
14	Cryptomeria-Chamaecyparis ECF	0.588	0.605
15	Deciduous Shrub	0.886	0.892
16	Euptelea DBF	0.849	0.849
17	Fagus DBF	0.671	0.684
18	Fraxinus DBF	0.879	0.881
19	Hydrangea Shrub	0.614	0.614
20	Juglans DBF	0.778	0.790
21	Larix DCF	0.591	0.608
22	Mallotus DBF	0.639	0.639
23	Miscanthus Herb	0.671	0.683
24	Open space Herb	0.788	0.806
25	Paddy field	0.659	0.672
26	Pasture	0.723	0.730
27	Picea ECF	0.713	0.713
28	Pinus ECF	0.857	0.876
29	Pinus Shrub	0.872	0.875
30	Populus DBF	0.657	0.657
31	Pterocarya DBF	0.858	0.870
32	Quercus DBF	0.569	0.590
33	Quercus EBF	0.723	0.724
34	Quercus Shrub	0.683	0.684
35	Rhododendron Shrub	0.607	0.607
36	Robinia DBF	0.740	0.752
37	Salix DBF	0.762	0.771
38	Salix Shrub	0.688	0.690
39	Sasa Shrub	0.736	0.746
40	Thuja ECF	0.688	0.694
41	Tsuga ECF	0.869	0.886
42	Ulmus DBF	0.705	0.707
43	Upland field	0.841	0.859
44	Water	0.725	0.736
45	Weigela Shrub	0.884	0.891

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

46	Wetland Herb	0.778	0.789
47	Zelkova DBF	0.784	0.805
48	Zoysia Herb	0.843	0.843

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.28. Nagasaki prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.597	0.627
2	Abies ECF	0.755	0.756
3	Acer DBF	0.809	0.809
4	Alpine Herb	0.875	0.875
5	Ardisia EBF	0.866	0.867
6	Bamboo EBF	0.788	0.827
7	Barren	0.742	0.761
8	Builtup	0.583	0.618
9	Carpinus Shrub	0.823	0.824
10	Castanopsis EBF	0.664	0.669
11	Celtis DBF	0.556	0.558
12	Coastal Herb	0.746	0.749
13	Cryptomeria-Chamaecyparis ECF	0.858	0.892
14	Deciduous Shrub	0.640	0.660
15	Evodia DBF	0.640	0.640
16	Hydrangea Shrub	0.829	0.829
17	Lithocarpus EBF	0.868	0.881
18	Litsea EBF	0.858	0.865
19	Machilus EBF	0.849	0.874
20	Mallotus DBF	0.503	0.540
21	Miscanthus Herb	0.766	0.779
22	Open space Herb	0.767	0.791
23	Paddy field	0.591	0.619
24	Pasture	0.718	0.722
25	Pinus ECF	0.616	0.629
26	Quercus DBF	0.676	0.702
27	Quercus EBF	0.631	0.672
28	Rhododendron Shrub	0.855	0.856
29	Sasa Shrub	0.605	0.610
30	Upland field	0.754	0.793
31	Water	0.793	0.799
32	Wetland Herb	0.712	0.719
33	Zelkova DBF	0.735	0.738
34	Zoysia Herb	0.602	0.602

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.29. Nara prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.596	0.605
2	Abies ECF	0.864	0.881
3	Bamboo EBF	0.841	0.854
4	Barren	0.720	0.734
5	Builtup	0.675	0.702
6	Carpinus DBF	0.809	0.847
7	Castanopsis EBF	0.792	0.793
8	Cryptomeria-Chamaecyparis ECF	0.608	0.639
9	Fagus DBF	0.773	0.791
10	Mallotus DBF	0.638	0.646
11	Miscanthus Herb	0.791	0.795
12	Open space Herb	0.836	0.861
13	Paddy field	0.690	0.713
14	Pasture	0.811	0.812
15	Picea ECF	0.751	0.752
16	Pinus ECF	0.799	0.834
17	Podocarpus ECF	0.814	0.814
18	Pterocarya DBF	0.652	0.652
19	Quercus DBF	0.679	0.717
20	Quercus EBF	0.649	0.678
21	Tsuga ECF	0.611	0.631
22	Upland field	0.586	0.617
23	Water	0.789	0.801
24	Wetland Herb	0.604	0.605
25	Zelkova DBF	0.676	0.680

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.30. Niigata prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.797	0.812
2	Abies ECF	0.818	0.821
3	Acer DBF	0.788	0.788
4	Acer Shrub	0.733	0.735
5	Alnus DBF	0.699	0.701
6	Alnus Shrub	0.746	0.757
7	Alpine Herb	0.693	0.701
8	Alpine Shrub	0.752	0.754
9	Bamboo EBF	0.672	0.677
10	Barren	0.873	0.889
11	Betula DBF	0.716	0.728
12	Builtup	0.716	0.728
13	Carpinus DBF	0.829	0.829
14	Castanopsis EBF	0.721	0.722
15	Coastal Herb	0.724	0.725
16	Cryptomeria-Chamaecyparis ECF	0.647	0.662
17	Deciduous Shrub	0.882	0.899
18	Elaeagnus Shrub	0.857	0.857
19	Fagus DBF	0.837	0.855
20	Hydrangea Shrub	0.634	0.649
21	Juglans DBF	0.828	0.836
22	Larix DCF	0.798	0.801
23	Machilus EBF	0.876	0.877
24	Miscanthus Herb	0.789	0.809
25	Open space Herb	0.836	0.852
26	Paddy field	0.752	0.762
27	Pasture	0.715	0.721
28	Pinus ECF	0.749	0.759
29	Pinus Shrub	0.803	0.803
30	Populus DBF	0.759	0.759
31	Pterocarya DBF	0.624	0.628
32	Quercus DBF	0.786	0.803
33	Quercus Shrub	0.631	0.646
34	Rhododendron Shrub	0.772	0.773
35	Robinia DBF	0.653	0.654
36	Salix DBF	0.639	0.644
37	Salix Shrub	0.879	0.882
38	Sasa Shrub	0.706	0.714
39	Thuja ECF	0.642	0.653
40	Tilia DBF	0.889	0.890
41	Tsuga ECF	0.685	0.686
42	Upland field	0.625	0.639
43	Water	0.728	0.739
44	Weigela Shrub	0.595	0.610
45	Wetland Herb	0.589	0.601

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

46	Zelkova DBF	0.771	0.776
47	Zoysia Herb	0.812	0.812

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.31. Oita prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.547	0.562
2	Abies ECF	0.899	0.899
3	Alpine Herb	0.760	0.761
4	Alpine Shrub	0.612	0.612
5	Bamboo EBF	0.756	0.792
6	Barren	0.698	0.719
7	Builtup	0.851	0.882
8	Carpinus DBF	0.712	0.729
9	Carpinus Shrub	0.732	0.733
10	Castanopsis EBF	0.729	0.734
11	Celtis DBF	0.827	0.832
12	Coastal Herb	0.866	0.867
13	Cornus DBF	0.724	0.727
14	Cryptomeria-Chamaecyparis ECF	0.699	0.739
15	Fagus DBF	0.749	0.754
16	Fraxinus DBF	0.795	0.797
17	Hydrangea Shrub	0.658	0.663
18	Larix DCF	0.813	0.813
19	Machilus EBF	0.852	0.855
20	Mallotus DBF	0.551	0.589
21	Miscanthus Herb	0.631	0.651
22	Open space Herb	0.713	0.737
23	Paddy field	0.583	0.608
24	Pasture	0.611	0.624
25	Pinus ECF	0.719	0.754
26	Quercus DBF	0.617	0.651
27	Quercus EBF	0.663	0.701
28	Rhododendron Shrub	0.782	0.785
29	Salix DBF	0.362	0.362
30	Sasa Shrub	0.681	0.682
31	Sorbus DBF	0.810	0.811
32	Tsuga ECF	0.742	0.745
33	Upland field	0.699	0.737
34	Water	0.699	0.713
35	Wetland Herb	0.652	0.664
36	Zelkova DBF	0.709	0.721

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.32. Okayama prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.630	0.667
2	Abies ECF	0.699	0.699
3	Alnus DBF	0.522	0.522
4	Alnus Shrub	0.718	0.718
5	Alpine Shrub	0.769	0.769
6	Bamboo EBF	0.844	0.876
7	Barren	0.689	0.718
8	Builtup	0.606	0.636
9	Carpinus DBF	0.640	0.642
10	Castanopsis EBF	0.842	0.842
11	Celtis DBF	0.710	0.714
12	Cryptomeria-Chamaecyparis ECF	0.622	0.650
13	Deciduous Shrub	0.675	0.706
14	Fagus DBF	0.815	0.817
15	Hydrangea Shrub	0.874	0.877
16	Larix DCF	0.669	0.670
17	Mallotus DBF	0.731	0.749
18	Miscanthus Herb	0.668	0.684
19	Open space Herb	0.803	0.831
20	Paddy field	0.623	0.648
21	Pasture	0.764	0.783
22	Pinus ECF	0.831	0.865
23	Pterocarya DBF	0.892	0.892
24	Quercus DBF	0.645	0.685
25	Quercus EBF	0.666	0.680
26	Salix DBF	0.745	0.746
27	Salix Shrub	0.603	0.603
28	Sasa Shrub	0.604	0.607
29	Upland field	0.683	0.727
30	Water	0.762	0.778
31	Wetland Herb	0.766	0.784
32	Zelkova DBF	0.855	0.865

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.33. Okinawa prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.517	0.537
2	Acacia EBF	0.673	0.674
3	Alnus DBF	0.585	0.592
4	Bamboo Shrub	0.836	0.838
5	Barren	0.542	0.565
6	Builtup	0.631	0.681
7	Castanopsis EBF	0.673	0.709
8	Coastal Herb	0.772	0.773
9	Deciduous Shrub	0.864	0.875
10	Diospyros EBF	0.813	0.814
11	Fraxinus DBF	0.848	0.848
12	Litsea EBF	0.859	0.866
13	Miscanthus Herb	0.608	0.663
14	Open space Herb	0.789	0.818
15	Paddy field	0.845	0.850
16	Palm ECF	0.708	0.708
17	Pandanus ECF	0.680	0.686
18	Pasture	0.609	0.623
19	Pinus ECF	0.713	0.776
20	Pongamia EBF	0.680	0.681
21	Schima EBF	0.571	0.618
22	Treefern ECF	0.682	0.682
23	Trema EBF	0.624	0.682
24	Upland field	0.768	0.815
25	Water	0.661	0.666
26	Wetland Herb	0.583	0.586

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.34. Osaka prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.437	0.440
2	Bamboo EBF	0.803	0.836
3	Barren	0.604	0.636
4	Builtup	0.662	0.705
5	Carpinus DBF	0.754	0.755
6	Castanopsis EBF	0.553	0.555
7	Cryptomeria-Chamaecyparis ECF	0.614	0.659
8	Mallotus DBF	0.611	0.614
9	Miscanthus Herb	0.491	0.497
10	Open space Herb	0.768	0.806
11	Paddy field	0.661	0.695
12	Pasture	0.650	0.660
13	Pinus ECF	0.797	0.849
14	Quercus DBF	0.731	0.789
15	Quercus EBF	0.811	0.833
16	Salix DBF	0.565	0.566
17	Upland field	0.691	0.729
18	Water	0.784	0.800
19	Wetland Herb	0.609	0.616
20	Zelkova DBF	0.551	0.555

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.35. Saga prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.471	0.488
2	Alpine Herb	0.707	0.708
3	Bamboo EBF	0.768	0.816
4	Barren	0.579	0.598
5	Builtup	0.649	0.684
6	Carpinus DBF	0.754	0.759
7	Castanopsis EBF	0.608	0.611
8	Coastal Herb	0.809	0.810
9	Cryptomeria-Chamaecyparis ECF	0.803	0.855
10	Deciduous Shrub	0.445	0.447
11	Lithocarpus EBF	0.565	0.569
12	Litsea EBF	0.671	0.672
13	Machilus EBF	0.687	0.696
14	Mallotus DBF	0.524	0.576
15	Miscanthus Herb	0.600	0.613
16	Open space Herb	0.691	0.715
17	Paddy field	0.695	0.724
18	Pasture	0.673	0.677
19	Pinus ECF	0.825	0.852
20	Quercus DBF	0.592	0.621
21	Quercus EBF	0.657	0.709
22	Salix DBF	0.585	0.586
23	Sasa Shrub	0.803	0.804
24	Upland field	0.724	0.778
25	Water	0.687	0.702
26	Wetland Herb	0.688	0.701
27	Zelkova DBF	0.636	0.639

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.36. Saitama prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.572	0.594
2	Abies ECF	0.615	0.618
3	Alnus DBF	0.865	0.865
4	Bamboo EBF	0.646	0.654
5	Barren	0.743	0.767
6	Betula DBF	0.844	0.846
7	Builtup	0.576	0.624
8	Carpinus DBF	0.838	0.845
9	Cryptomeria-Chamaecyparis ECF	0.728	0.756
10	Deciduous Shrub	0.666	0.675
11	Euptelea DBF	0.794	0.796
12	Fagus DBF	0.681	0.686
13	Fraxinus DBF	0.842	0.845
14	Hydrangea Shrub	0.739	0.739
15	Larix DCF	0.777	0.780
16	Mallotus DBF	0.706	0.707
17	Miscanthus Herb	0.750	0.768
18	Open space Herb	0.845	0.882
19	Paddy field	0.719	0.747
20	Pasture	0.874	0.876
21	Pinus ECF	0.779	0.811
22	Pterocarya DBF	0.804	0.805
23	Quercus DBF	0.691	0.731
24	Quercus EBF	0.554	0.561
25	Robinia DBF	0.701	0.704
26	Salix Shrub	0.678	0.680
27	Sasa Shrub	0.808	0.809
28	Tsuga ECF	0.596	0.601
29	Upland field	0.799	0.846
30	Water	0.676	0.700
31	Wetland Herb	0.670	0.681
32	Zelkova DBF	0.730	0.740

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.37. Shiga prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.506	0.518
2	Abies ECF	0.578	0.581
3	Acer DBF	0.681	0.681
4	Alnus DBF	0.503	0.504
5	Alnus Shrub	0.594	0.595
6	Alpine Shrub	0.763	0.764
7	Bamboo EBF	0.813	0.839
8	Barren	0.562	0.586
9	Builtup	0.649	0.683
10	Carpinus DBF	0.778	0.799
11	Castanopsis EBF	0.465	0.470
12	Coastal Herb	0.492	0.493
13	Cryptomeria-Chamaecyparis ECF	0.588	0.627
14	Deciduous Shrub	0.880	0.881
15	Euptelea DBF	0.581	0.582
16	Fagus DBF	0.762	0.772
17	Juglans DBF	0.787	0.787
18	Mallotus DBF	0.435	0.437
19	Miscanthus Herb	0.580	0.594
20	Open space Herb	0.737	0.772
21	Paddy field	0.790	0.809
22	Pasture	0.633	0.637
23	Pinus ECF	0.777	0.824
24	Pterocarya DBF	0.558	0.561
25	Quercus DBF	0.561	0.601
26	Quercus EBF	0.499	0.505
27	Salix DBF	0.591	0.597
28	Salix Shrub	0.495	0.496
29	Sasa Shrub	0.778	0.779
30	Upland field	0.761	0.792
31	Water	0.973	0.975
32	Weigela Shrub	0.723	0.724
33	Wetland Herb	0.745	0.767
34	Zelkova DBF	0.699	0.721

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.38. Shimane prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.588	0.618
2	Abies ECF	0.617	0.617
3	Alnus DBF	0.652	0.652
4	Bamboo EBF	0.809	0.843
5	Barren	0.664	0.689
6	Builtup	0.569	0.601
7	Carpinus DBF	0.713	0.722
8	Castanopsis EBF	0.609	0.612
9	Celtis DBF	0.607	0.609
10	Coastal Herb	0.833	0.834
11	Cryptomeria-Chamaecyparis ECF	0.808	0.842
12	Deciduous Shrub	0.809	0.843
13	Fagus DBF	0.808	0.809
14	Hydrangea Shrub	0.669	0.670
15	Juglans DBF	0.855	0.856
16	Larix DCF	0.805	0.805
17	Litsea EBF	0.766	0.773
18	Machilus EBF	0.868	0.872
19	Mallotus DBF	0.720	0.734
20	Miscanthus Herb	0.589	0.605
21	Open space Herb	0.605	0.626
22	Paddy field	0.577	0.604
23	Pasture	0.854	0.866
24	Pinus ECF	0.648	0.688
25	Pterocarya DBF	0.844	0.845
26	Quercus DBF	0.625	0.664
27	Quercus EBF	0.771	0.805
28	Rhododendron Shrub	0.820	0.820
29	Salix DBF	0.759	0.760
30	Salix Shrub	0.723	0.724
31	Sasa Shrub	0.653	0.660
32	Thuja ECF	0.722	0.723
33	Upland field	0.668	0.706
34	Water	0.873	0.882
35	Wetland Herb	0.680	0.695
36	Zelkova DBF	0.752	0.764

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.39. Shizuoka prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.519	0.528
2	Abies ECF	0.787	0.806
3	Alnus DBF	0.670	0.672
4	Alpine Herb	0.650	0.651
5	Alpine Shrub	0.677	0.680
6	Bamboo EBF	0.850	0.870
7	Barren	0.711	0.733
8	Betula DBF	0.633	0.645
9	Builtup	0.590	0.613
10	Carpinus DBF	0.780	0.805
11	Castanopsis EBF	0.624	0.631
12	Celtis DBF	0.578	0.579
13	Coastal Herb	0.799	0.801
14	Cryptomeria-Chamaecyparis ECF	0.842	0.865
15	Deciduous Shrub	0.668	0.684
16	Euptelea DBF	0.745	0.746
17	Fagus DBF	0.864	0.886
18	Fraxinus DBF	0.619	0.621
19	Hydrangea Shrub	0.789	0.794
20	Larix DCF	0.614	0.632
21	Machilus EBF	0.679	0.680
22	Mallotus DBF	0.621	0.631
23	Miscanthus Herb	0.708	0.720
24	Open space Herb	0.873	0.891
25	Paddy field	0.686	0.700
26	Pasture	0.702	0.706
27	Picea ECF	0.682	0.682
28	Pinus ECF	0.763	0.786
29	Pinus Shrub	0.741	0.742
30	Prunus DBF	0.692	0.692
31	Pterocarya DBF	0.632	0.640
32	Quercus DBF	0.504	0.524
33	Quercus EBF	0.684	0.710
34	Salix DBF	0.641	0.647
35	Salix Shrub	0.654	0.657
36	Sasa Shrub	0.641	0.643
37	Tsuga ECF	0.781	0.805
38	Upland field	0.771	0.795
39	Water	0.777	0.787
40	Wetland Herb	0.674	0.688
41	Zelkova DBF	0.669	0.679

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.40. Tochigi prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.579	0.592
2	Abies ECF	0.731	0.741
3	Acer Shrub	0.732	0.733
4	Alnus DBF	0.728	0.732
5	Alnus Shrub	0.679	0.679
6	Alpine Herb	0.637	0.638
7	Alpine Shrub	0.639	0.640
8	Bamboo EBF	0.754	0.761
9	Barren	0.743	0.769
10	Betula DBF	0.652	0.670
11	Builtup	0.598	0.622
12	Carpinus DBF	0.872	0.876
13	Celtis DBF	0.855	0.856
14	Cryptomeria-Chamaecyparis ECF	0.644	0.664
15	Deciduous Shrub	0.768	0.782
16	Euptelea DBF	0.787	0.789
17	Fagus DBF	0.585	0.606
18	Larix DCF	0.768	0.781
19	Mallotus DBF	0.670	0.675
20	Miscanthus Herb	0.709	0.728
21	Open space Herb	0.618	0.638
22	Paddy field	0.703	0.719
23	Pasture	0.701	0.712
24	Picea ECF	0.713	0.714
25	Pinus ECF	0.775	0.801
26	Pinus Shrub	0.845	0.845
27	Pterocarya DBF	0.871	0.873
28	Quercus DBF	0.612	0.640
29	Quercus EBF	0.679	0.680
30	Quercus Shrub	0.828	0.828
31	Robinia DBF	0.724	0.726
32	Salix DBF	0.700	0.703
33	Salix Shrub	0.623	0.627
34	Sasa Shrub	0.610	0.615
35	Thuja ECF	0.771	0.773
36	Thujopsis ECF	0.664	0.669
37	Tsuga ECF	0.681	0.698
38	Ulmus DBF	0.763	0.764
39	Upland field	0.744	0.771
40	Water	0.678	0.695
41	Wetland Herb	0.829	0.847
42	Zelkova DBF	0.709	0.712

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.41. Tokushima prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.548	0.556
2	Abies ECF	0.582	0.607
3	Alpine Herb	0.780	0.780
4	Bamboo EBF	0.657	0.681
5	Barren	0.728	0.745
6	Betula DBF	0.864	0.867
7	Builtup	0.599	0.629
8	Carpinus DBF	0.799	0.829
9	Castanopsis EBF	0.651	0.652
10	Celtis DBF	0.540	0.547
11	Coastal Herb	0.722	0.723
12	Cornus DBF	0.582	0.589
13	Cryptomeria-Chamaecyparis ECF	0.593	0.623
14	Deciduous Shrub	0.706	0.719
15	Elaeagnus Shrub	0.666	0.666
16	Fagus DBF	0.690	0.701
17	Larix DCF	0.669	0.670
18	Machilus EBF	0.814	0.817
19	Mallotus DBF	0.670	0.681
20	Melia DBF	0.640	0.640
21	Miscanthus Herb	0.674	0.677
22	Open space Herb	0.730	0.750
23	Paddy field	0.639	0.663
24	Pasture	0.865	0.867
25	Pinus ECF	0.793	0.826
26	Pterocarya DBF	0.701	0.701
27	Quercus DBF	0.665	0.700
28	Quercus EBF	0.778	0.813
29	Rhododendron Shrub	0.655	0.657
30	Salix DBF	0.723	0.725
31	Salix Shrub	0.720	0.720
32	Sasa Shrub	0.676	0.678
33	Thujopsis ECF	0.755	0.755
34	Tsuga ECF	0.770	0.781
35	Upland field	0.754	0.790
36	Water	0.718	0.731
37	Wetland Herb	0.687	0.700
38	Zelkova DBF	0.758	0.771

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.42. Tokyo prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.538	0.542
2	Abies ECF	0.692	0.697
3	Alnus DBF	0.839	0.859
4	Bamboo EBF	0.711	0.719
5	Barren	0.856	0.882
6	Builtup	0.599	0.642
7	Calamagrostis Herb	0.727	0.727
8	Camellia EBF	0.684	0.685
9	Castanopsis EBF	0.735	0.755
10	Coastal Herb	0.833	0.838
11	Cryptomeria-Chamaecyparis ECF	0.764	0.786
12	Deciduous Shrub	0.596	0.602
13	Euptelea DBF	0.715	0.721
14	Eurya ECF	0.669	0.674
15	Fagus DBF	0.778	0.780
16	Fraxinus DBF	0.832	0.833
17	Hydrangea Shrub	0.794	0.798
18	Larix DCF	0.657	0.660
19	Machilus EBF	0.859	0.867
20	Miscanthus Herb	0.755	0.771
21	Open space Herb	0.599	0.630
22	Paddy field	0.618	0.625
23	Pasture	0.475	0.482
24	Pinus ECF	0.679	0.685
25	Prunus DBF	0.782	0.795
26	Quercus DBF	0.623	0.655
27	Quercus EBF	0.583	0.594
28	Robinia DBF	0.620	0.625
29	Sasa Shrub	0.854	0.855
30	Trochodendron EBF	0.825	0.828
31	Tsuga ECF	0.741	0.744
32	Upland field	0.832	0.871
33	Water	0.813	0.821
34	Wetland Herb	0.646	0.652
35	Zelkova DBF	0.542	0.542

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.43. Tottori prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.574	0.589
2	Alnus DBF	0.701	0.701
3	Alnus Shrub	0.833	0.835
4	Alpine Shrub	0.728	0.729
5	Bamboo EBF	0.831	0.858
6	Barren	0.663	0.677
7	Builtup	0.716	0.739
8	Carpinus DBF	0.802	0.816
9	Castanopsis EBF	0.702	0.704
10	Celtis DBF	0.717	0.717
11	Coastal Herb	0.658	0.659
12	Cryptomeria-Chamaecyparis ECF	0.865	0.900
13	Deciduous Shrub	0.647	0.661
14	Fagus DBF	0.837	0.850
15	Hydrangea Shrub	0.672	0.673
16	Juglans DBF	0.897	0.897
17	Larix DCF	0.707	0.707
18	Machilus EBF	0.764	0.764
19	Mallotus DBF	0.638	0.656
20	Miscanthus Herb	0.662	0.664
21	Open space Herb	0.708	0.732
22	Paddy field	0.676	0.699
23	Pasture	0.615	0.625
24	Pinus ECF	0.799	0.835
25	Pterocarya DBF	0.810	0.818
26	Quercus DBF	0.609	0.651
27	Quercus EBF	0.806	0.838
28	Robinia DBF	0.891	0.892
29	Salix DBF	0.724	0.725
30	Salix Shrub	0.712	0.712
31	Sasa Shrub	0.647	0.649
32	Upland field	0.851	0.883
33	Water	0.733	0.740
34	Wetland Herb	0.843	0.857
35	Zelkova DBF	0.864	0.887

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.44. Toyama prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.777	0.786
2	Abies ECF	0.733	0.748
3	Acer Shrub	0.628	0.630
4	Alnus DBF	0.832	0.834
5	Alnus Shrub	0.663	0.665
6	Alpine Herb	0.796	0.806
7	Alpine Shrub	0.814	0.814
8	Bamboo EBF	0.877	0.883
9	Barren	0.835	0.859
10	Betula DBF	0.578	0.602
11	Builtup	0.701	0.719
12	Carpinus DBF	0.662	0.668
13	Cryptomeria-Chamaecyparis ECF	0.625	0.646
14	Deciduous Shrub	0.821	0.833
15	Elaeagnus Shrub	0.586	0.586
16	Fagus DBF	0.814	0.840
17	Juglans DBF	0.880	0.882
18	Larix DCF	0.639	0.643
19	Miscanthus Herb	0.755	0.772
20	Open space Herb	0.791	0.808
21	Paddy field	0.698	0.714
22	Pasture	0.638	0.640
23	Pinus ECF	0.833	0.843
24	Pinus Shrub	0.809	0.814
25	Populus DBF	0.832	0.836
26	Pterocarya DBF	0.804	0.807
27	Quercus DBF	0.689	0.716
28	Quercus EBF	0.720	0.720
29	Quercus Shrub	0.645	0.648
30	Robinia DBF	0.655	0.656
31	Salix DBF	0.745	0.747
32	Salix Shrub	0.762	0.765
33	Sasa Shrub	0.661	0.664
34	Thuja ECF	0.671	0.689
35	Tsuga ECF	0.807	0.814
36	Upland field	0.859	0.873
37	Water	0.711	0.723
38	Weigela Shrub	0.857	0.882
39	Wetland Herb	0.817	0.827
40	Zelkova DBF	0.884	0.894

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.45. Wakayama prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.494	0.504
2	Abies ECF	0.652	0.670
3	Alnus DBF	0.650	0.651
4	Alpine Shrub	0.475	0.476
5	Bamboo EBF	0.663	0.685
6	Barren	0.689	0.712
7	Builtup	0.587	0.625
8	Carpinus DBF	0.660	0.680
9	Castanopsis EBF	0.761	0.771
10	Coastal Herb	0.633	0.633
11	Cryptomeria-Chamaecyparis ECF	0.845	0.885
12	Fagus DBF	0.712	0.713
13	Machilus EBF	0.608	0.619
14	Mallotus DBF	0.705	0.706
15	Miscanthus Herb	0.568	0.572
16	Open space Herb	0.738	0.764
17	Paddy field	0.833	0.868
18	Pasture	0.523	0.526
19	Pinus ECF	0.746	0.787
20	Quercus DBF	0.646	0.693
21	Quercus EBF	0.686	0.732
22	Salix DBF	0.679	0.681
23	Salix Shrub	0.811	0.811
24	Sasa Shrub	0.668	0.669
25	Sciadopitys ECF	0.675	0.676
26	Tsuga ECF	0.596	0.605
27	Upland field	0.826	0.866
28	Water	0.650	0.670
29	Wetland Herb	0.653	0.667
30	Zelkova DBF	0.699	0.702

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.46. Yamagata prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.656	0.673
2	Abies ECF	0.845	0.846
3	Acer DBF	0.845	0.847
4	Acer Shrub	0.978	0.979
5	Alnus DBF	0.737	0.737
6	Alnus Shrub	0.964	0.964
7	Alpine Herb	0.939	0.940
8	Alpine Shrub	0.837	0.838
9	Bamboo EBF	0.801	0.801
10	Barren	0.675	0.684
11	Betula DBF	0.874	0.877
12	Builtup	0.763	0.775
13	Coastal Herb	0.954	0.954
14	Costal Shrub	0.648	0.648
15	Cryptomeria-Chamaecyparis ECF	0.755	0.768
16	Deciduous Shrub	0.929	0.929
17	Fagus DBF	0.798	0.808
18	Fraxinus DBF	0.873	0.873
19	Hydrangea Shrub	0.707	0.716
20	Juglans DBF	0.859	0.869
21	Larix DCF	0.837	0.845
22	Machilus EBF	0.782	0.783
23	Miscanthus Herb	0.641	0.658
24	Open space Herb	0.704	0.717
25	Paddy field	0.809	0.818
26	Pasture	0.800	0.804
27	Pinus ECF	0.712	0.727
28	Pinus Shrub	0.980	0.980
29	Pterocarya DBF	0.711	0.718
30	Quercus DBF	0.583	0.603
31	Quercus Shrub	0.867	0.873
32	Rhododendron Shrub	0.976	0.976
33	Robinia DBF	0.882	0.885
34	Salix DBF	0.636	0.644
35	Salix Shrub	0.666	0.669
36	Sasa Shrub	0.899	0.901
37	Tilia DBF	0.930	0.930
38	Tsuga ECF	0.773	0.774
39	Upland field	0.658	0.675
40	Water	0.816	0.825
41	Weigela Shrub	0.798	0.808
42	Wetland Herb	0.798	0.804
43	Zelkova DBF	0.915	0.918

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.47. Yamaguchi prefecture accuracy

Map code	Legend	Kappa	F1-score
1	Abandoned land	0.692	0.727
2	Abies ECF	0.638	0.638
3	Bamboo EBF	0.831	0.864
4	Barren	0.713	0.737
5	Builtup	0.581	0.612
6	Carpinus DBF	0.643	0.643
7	Castanopsis EBF	0.729	0.732
8	Celtis DBF	0.668	0.684
9	Coastal Herb	0.848	0.848
10	Cryptomeria-Chamaecyparis ECF	0.858	0.891
11	Deciduous Shrub	0.613	0.632
12	Fagus DBF	0.822	0.822
13	Litsea EBF	0.854	0.854
14	Machilus EBF	0.649	0.667
15	Mallotus DBF	0.696	0.715
16	Miscanthus Herb	0.685	0.691
17	Open space Herb	0.780	0.805
18	Paddy field	0.581	0.608
19	Pasture	0.633	0.643
20	Pinus ECF	0.792	0.828
21	Quercus DBF	0.639	0.676
22	Quercus EBF	0.731	0.772
23	Salix DBF	0.573	0.574
24	Salix Shrub	0.663	0.663
25	Sasa Shrub	0.616	0.623
26	Upland field	0.695	0.736
27	Water	0.767	0.780
28	Wetland Herb	0.652	0.665
29	Zelkova DBF	0.711	0.713

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

2.48. Yamanashi prefecture accuracy

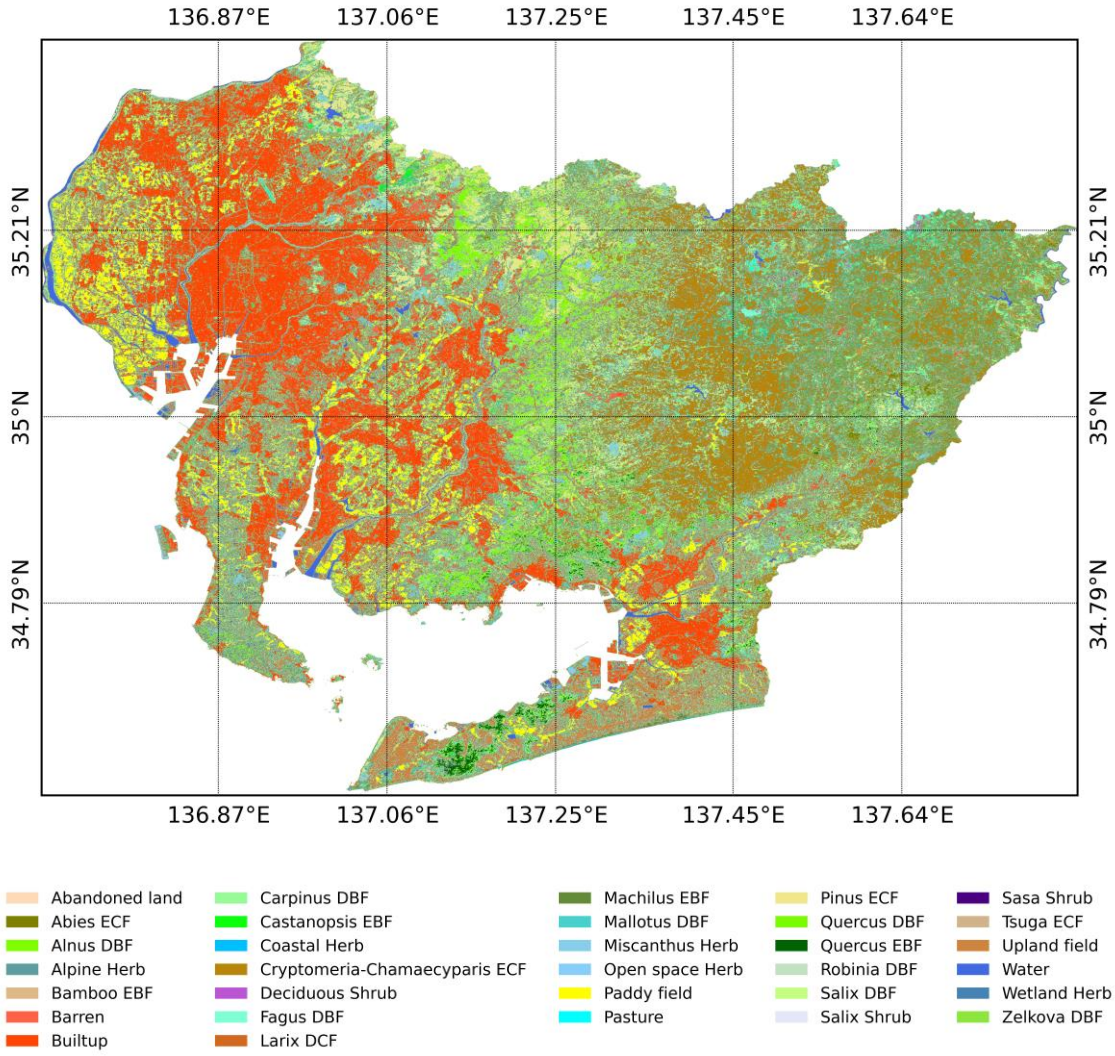
Map code	Legend	Kappa	F1-score
1	Abandoned land	0.542	0.548
2	Abies ECF	0.710	0.728
3	Alnus DBF	0.717	0.724
4	Alpine Herb	0.708	0.710
5	Alpine Shrub	0.677	0.677
6	Bamboo EBF	0.673	0.677
7	Barren	0.812	0.832
8	Betula DBF	0.584	0.603
9	Builtup	0.662	0.684
10	Carpinus DBF	0.585	0.602
11	Cryptomeria-Chamaecyparis ECF	0.613	0.638
12	Deciduous Shrub	0.673	0.683
13	Euptelea DBF	0.609	0.614
14	Fagus DBF	0.833	0.862
15	Fraxinus DBF	0.770	0.776
16	Hydrangea Shrub	0.718	0.722
17	Juglans DBF	0.749	0.754
18	Larix DCF	0.873	0.898
19	Mallotus DBF	0.793	0.795
20	Miscanthus Herb	0.663	0.671
21	Open space Herb	0.884	0.899
22	Paddy field	0.693	0.711
23	Pasture	0.706	0.708
24	Picea ECF	0.776	0.776
25	Pinus ECF	0.808	0.837
26	Pinus Shrub	0.673	0.674
27	Populus DBF	0.891	0.891
28	Pterocarya DBF	0.723	0.727
29	Quercus DBF	0.595	0.625
30	Quercus EBF	0.450	0.450
31	Robinia DBF	0.671	0.676
32	Salix DBF	0.642	0.645
33	Salix Shrub	0.792	0.792
34	Sasa Shrub	0.699	0.699
35	Tsuga ECF	0.834	0.862
36	Upland field	0.593	0.617
37	Water	0.752	0.760
38	Wetland Herb	0.709	0.720
39	Zelkova DBF	0.754	0.773

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

Appendix 3.

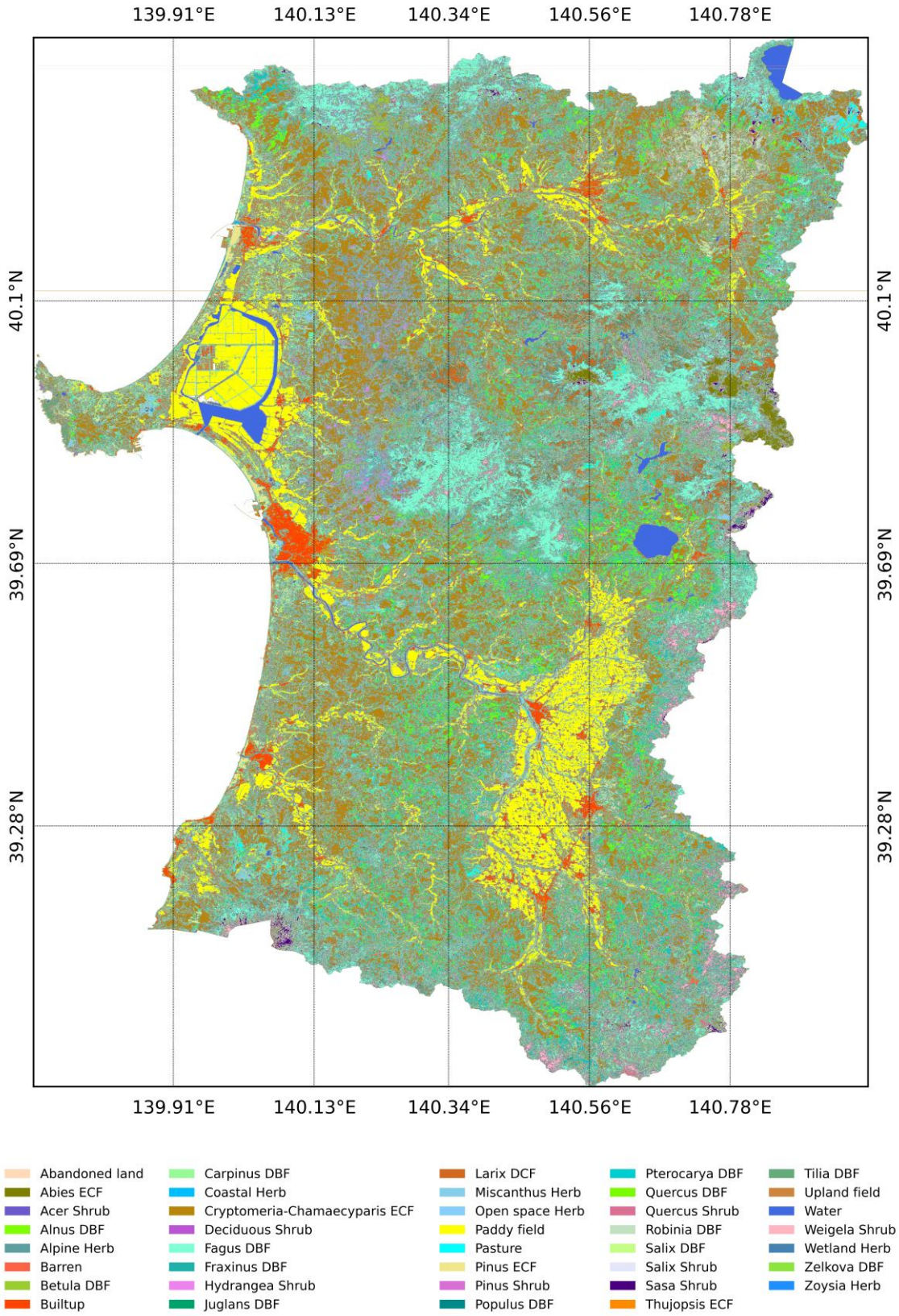
Genus-Physiognomy-Ecosystem (GPE) maps produced in the research.

3.1. Aichi prefecture GPE map



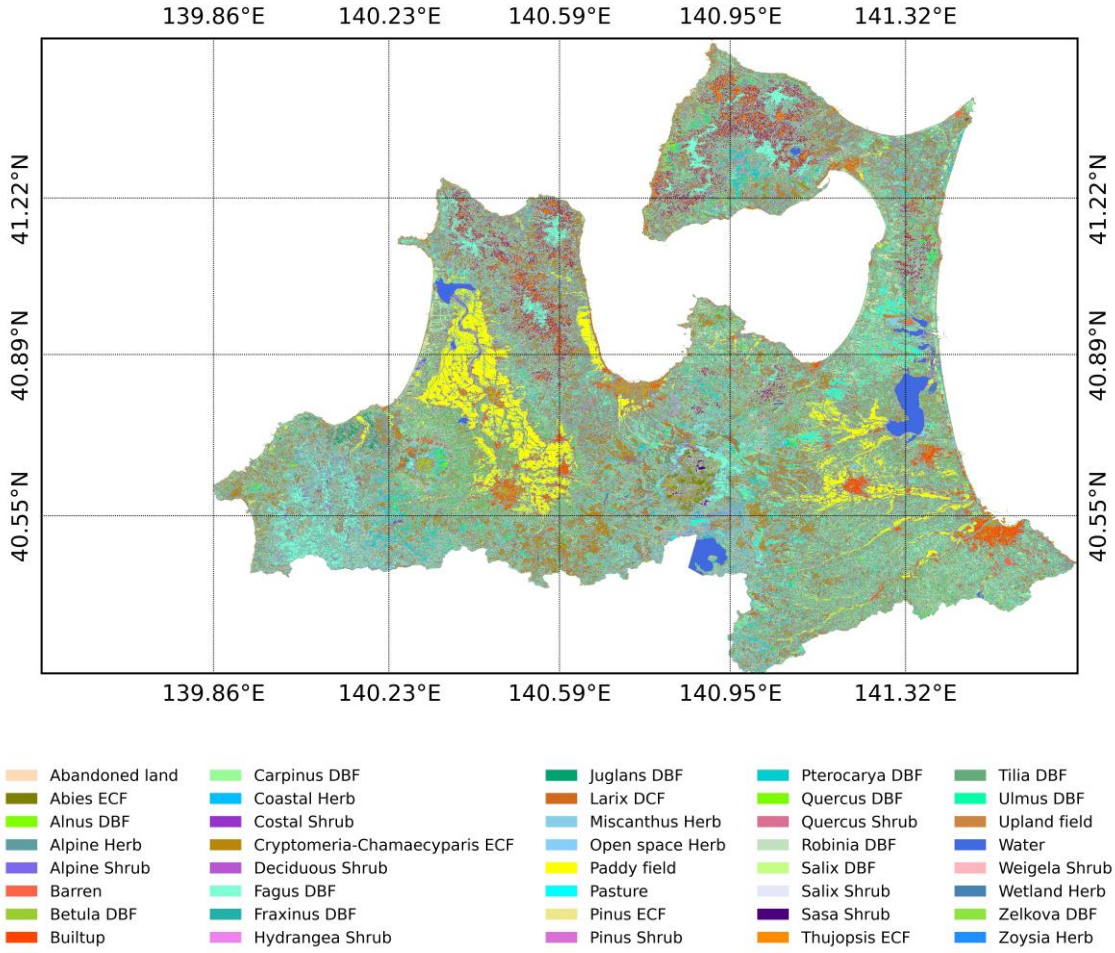
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.2. Akita prefecture GPE map



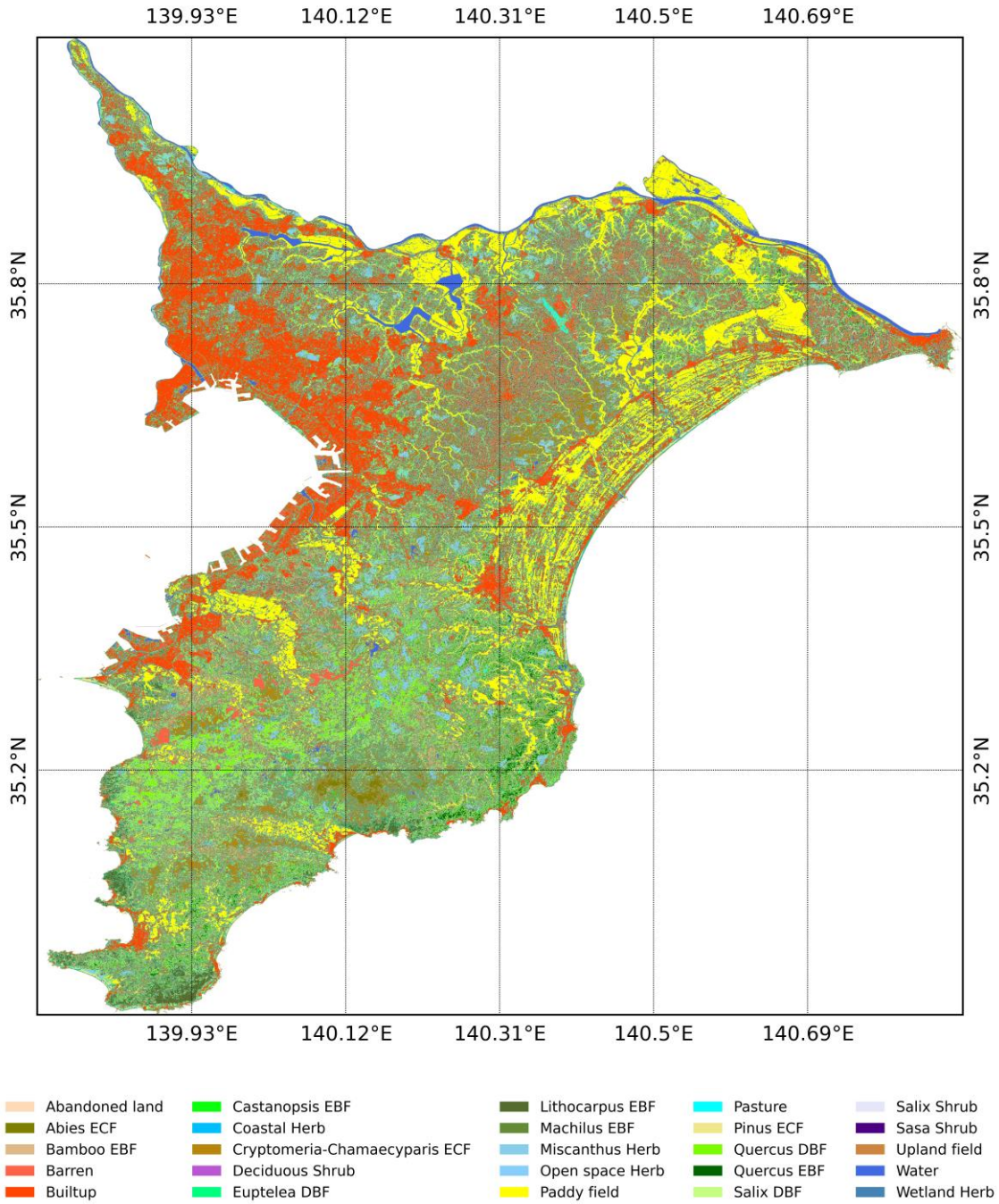
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.3. Aomori prefecture GPE map



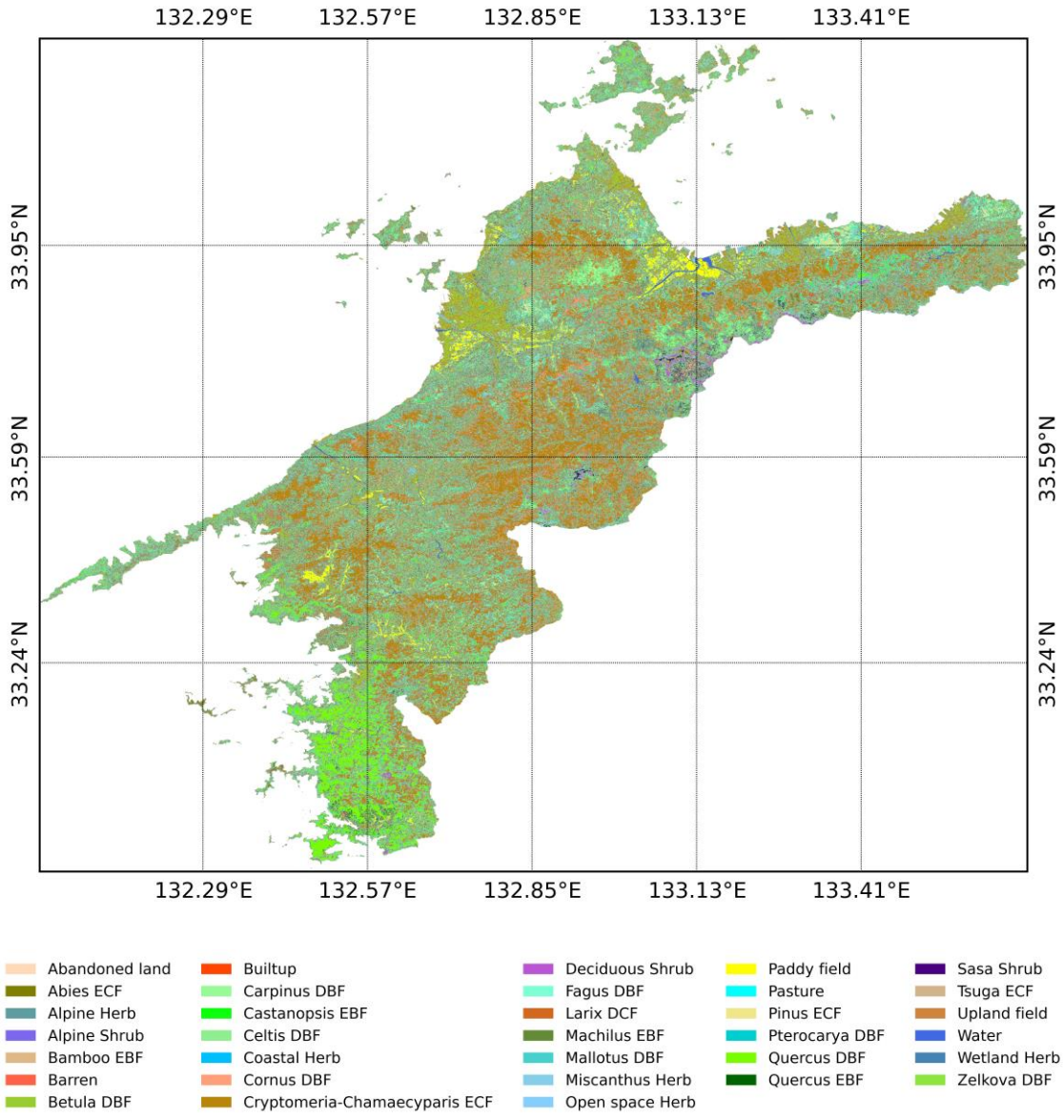
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.4. Chiba prefecture GPE map



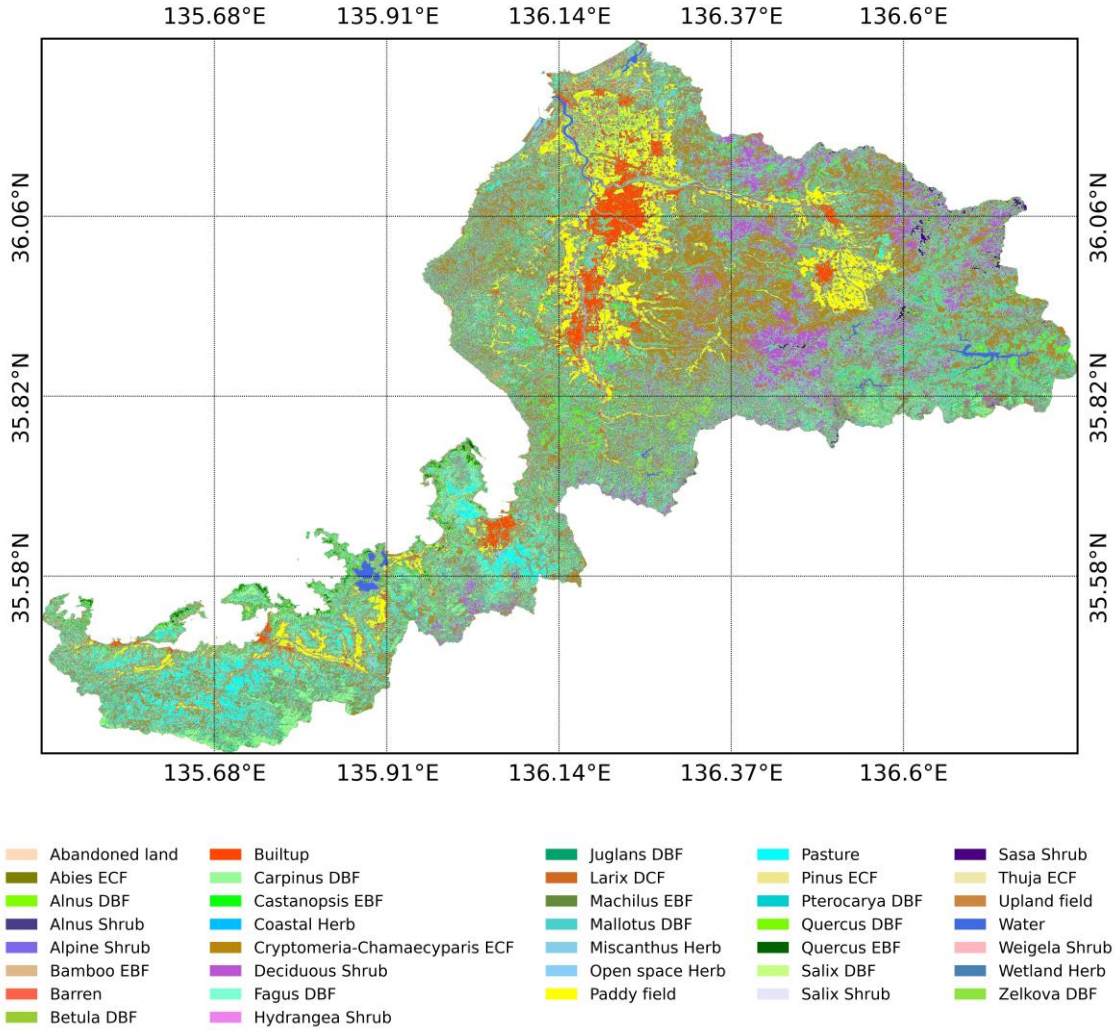
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.5. Ehime prefecture GPE map



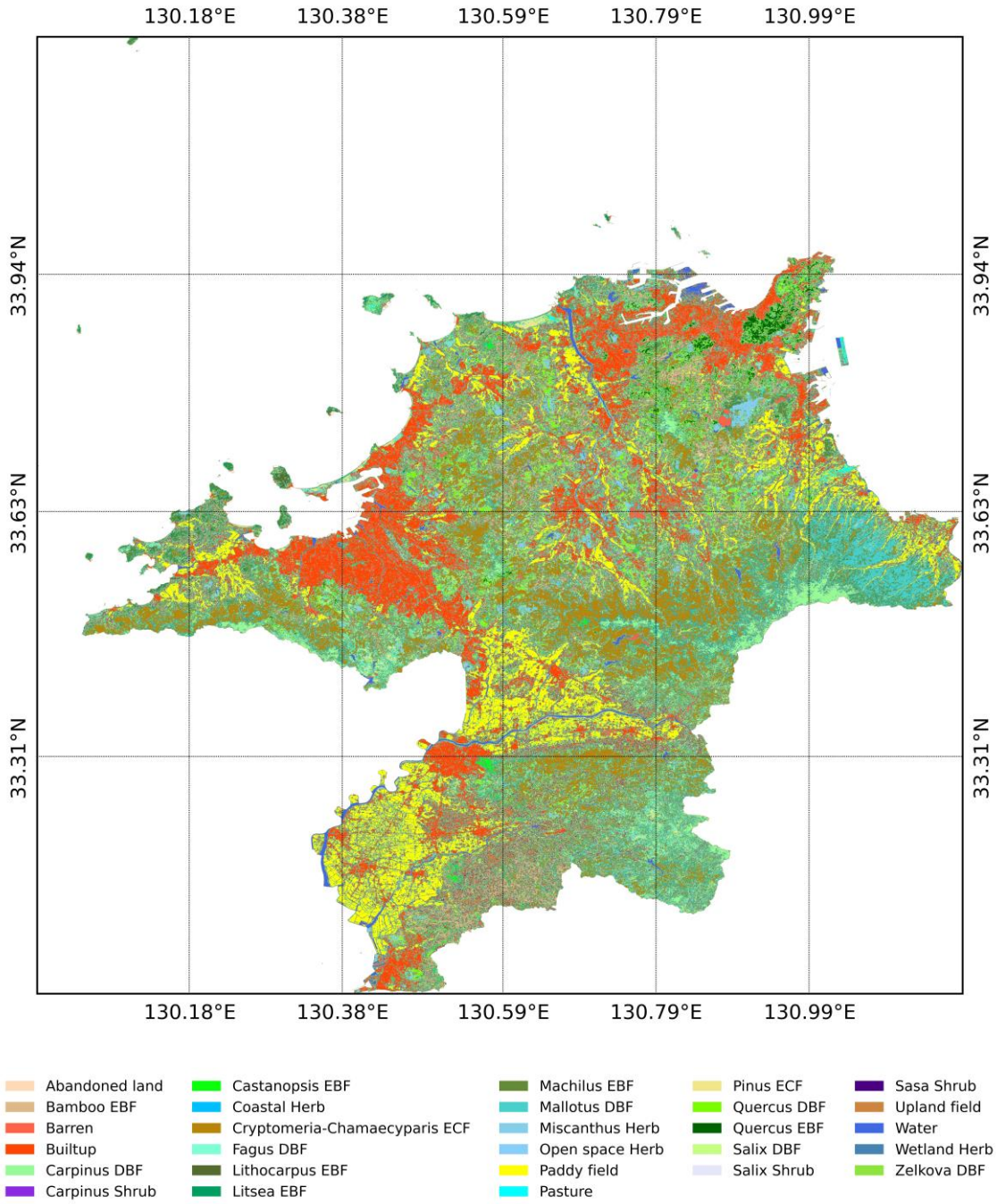
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.6. Fukui prefecture GPE map



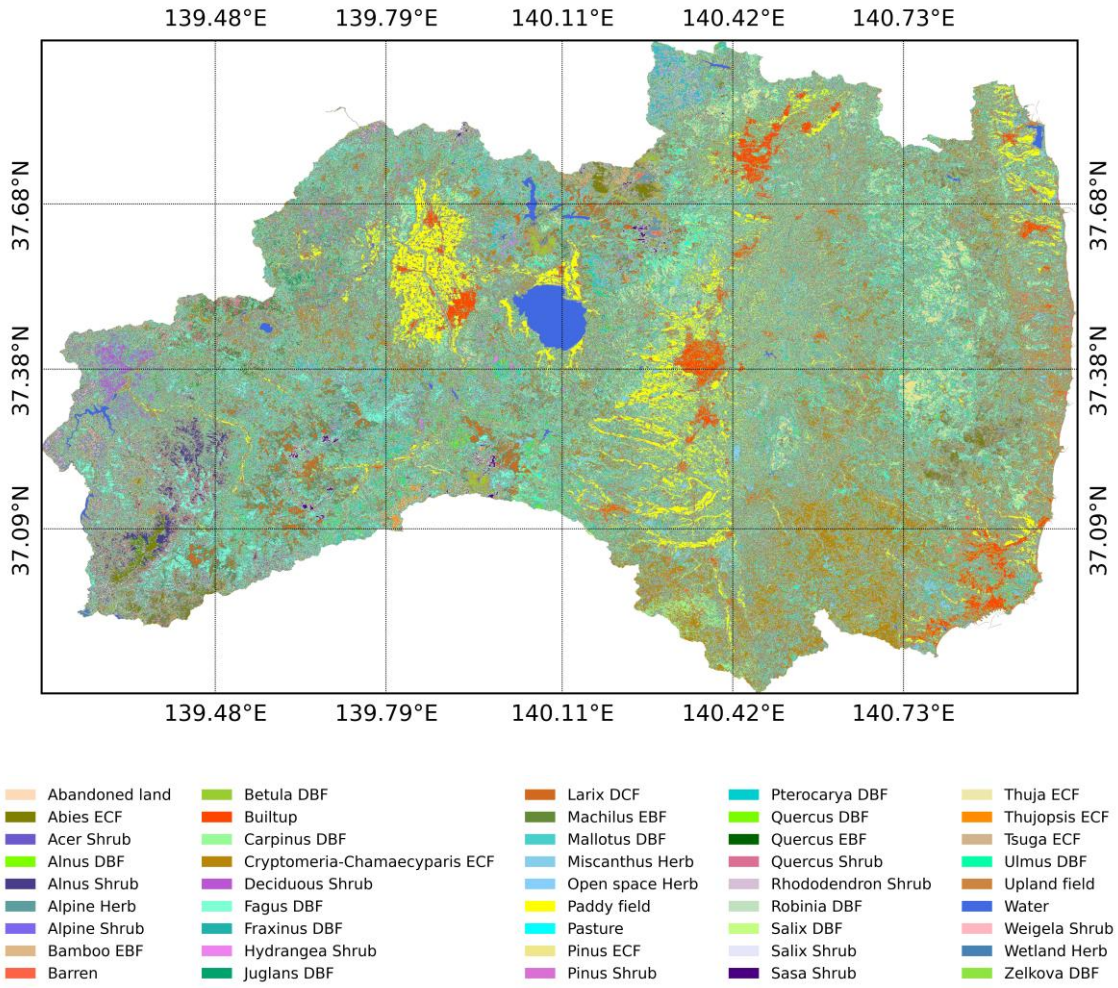
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.7. Fukuoka prefecture GPE map



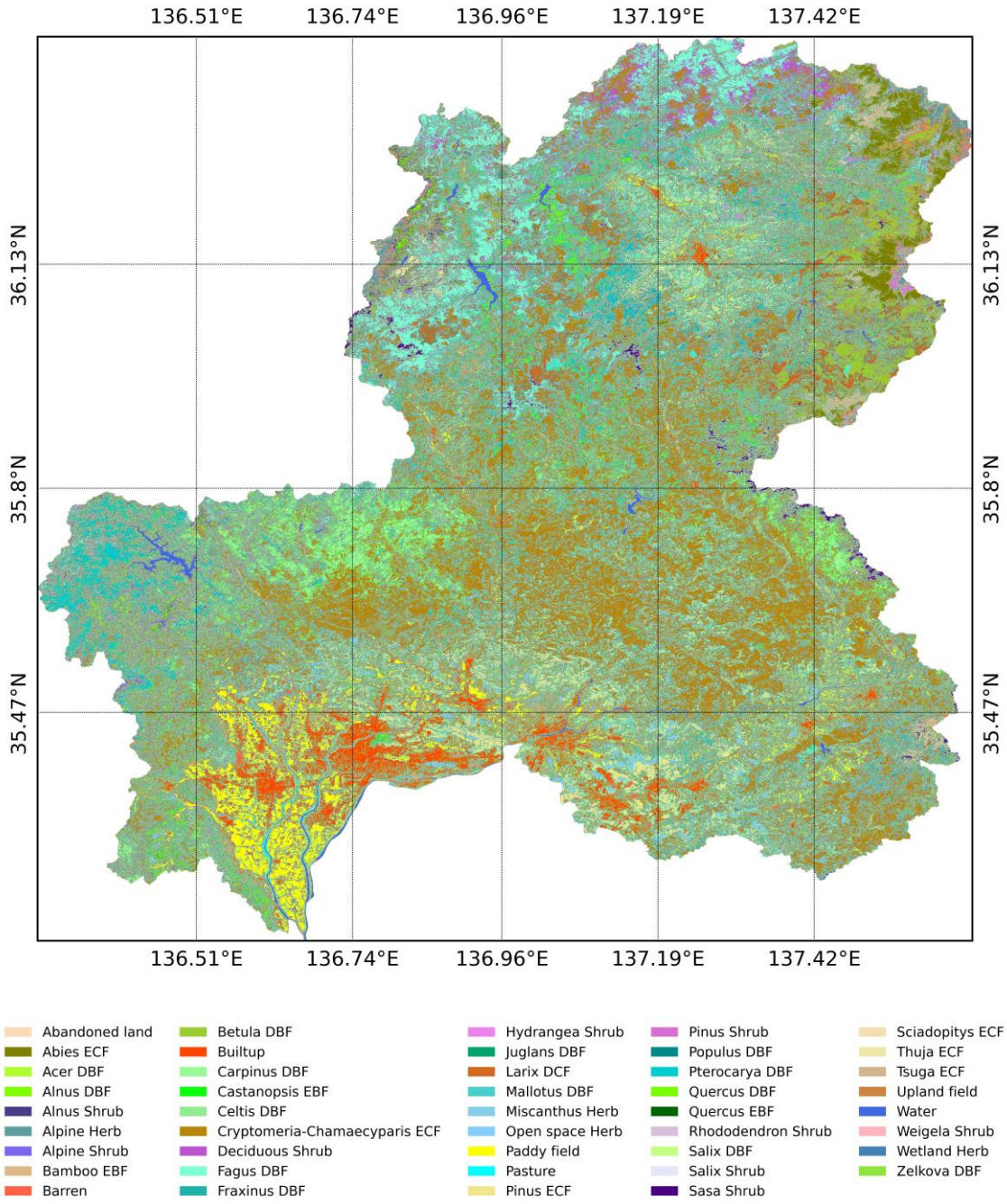
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.8. Fukushima prefecture GPE map



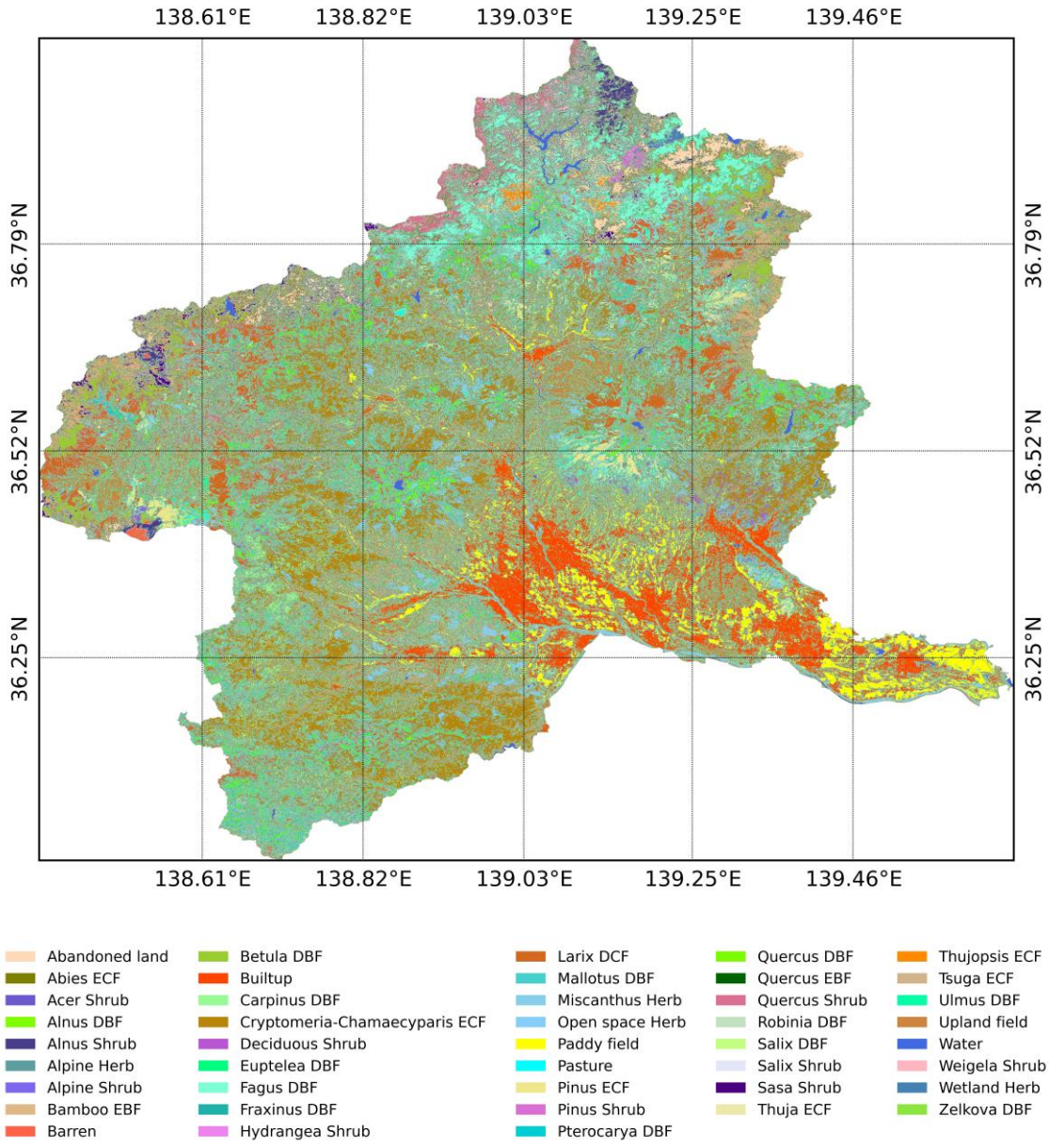
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.9. Gifu prefecture GPE map



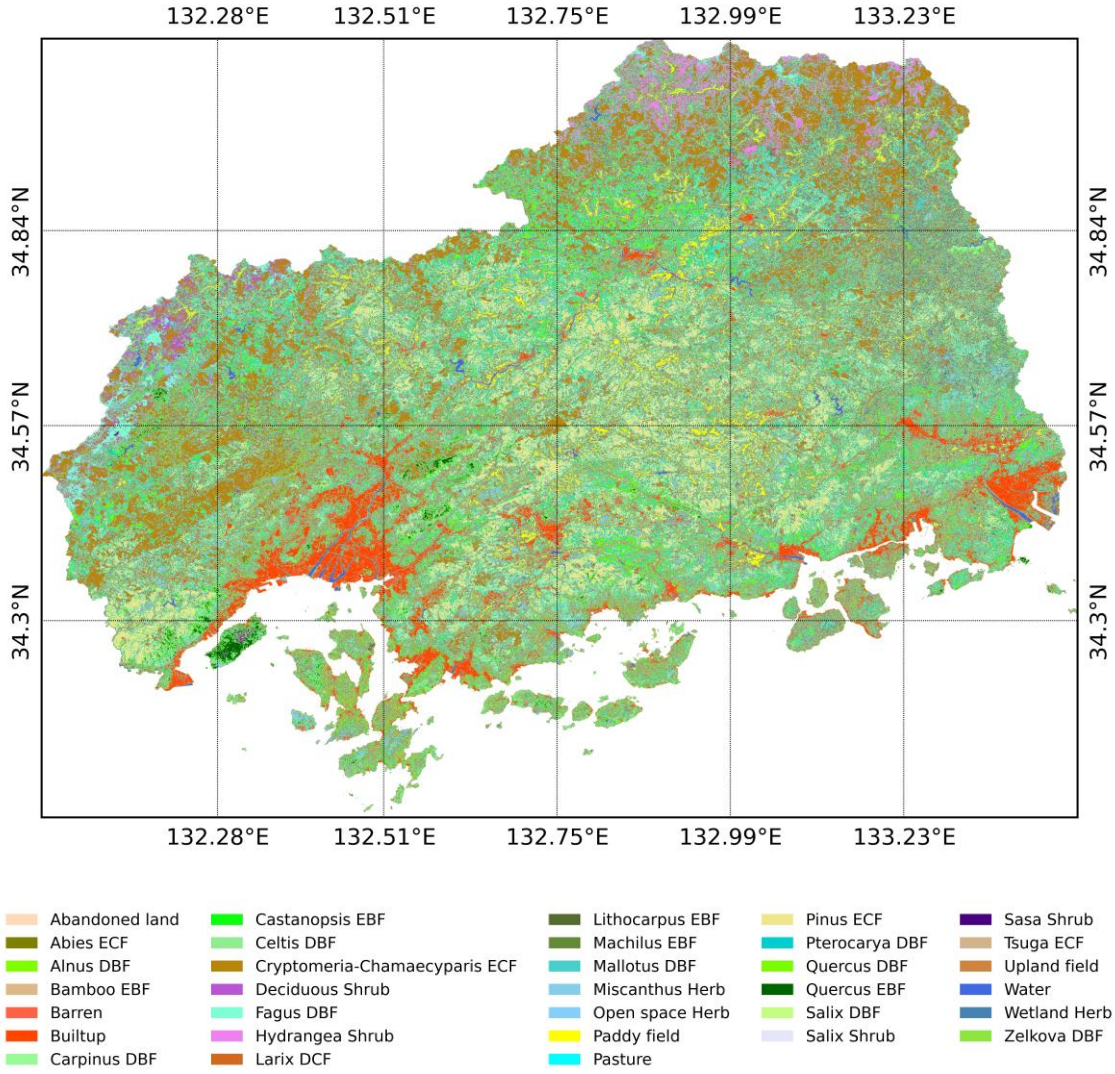
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.10. Gunma prefecture GPE map



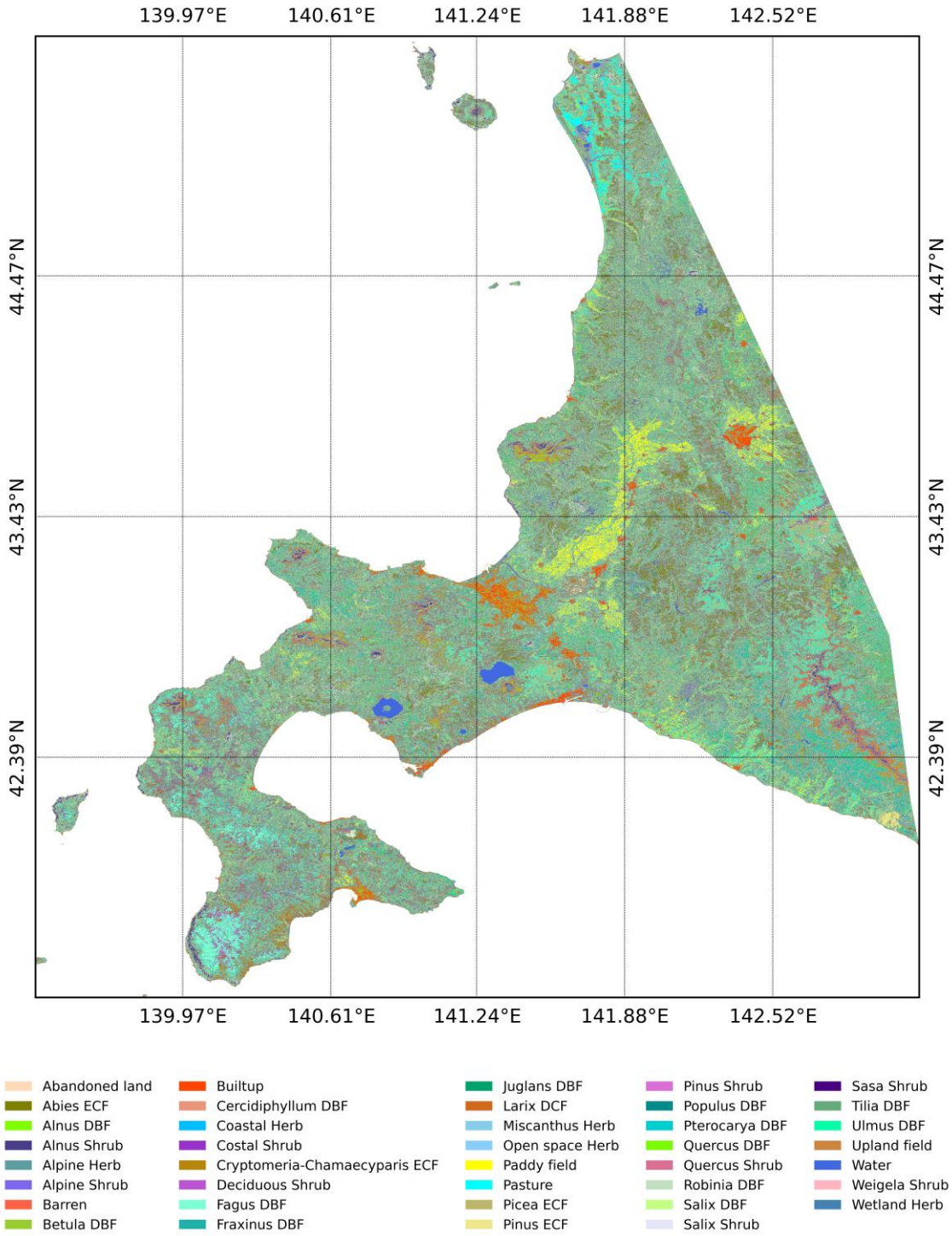
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.11. Hiroshima prefecture GPE map



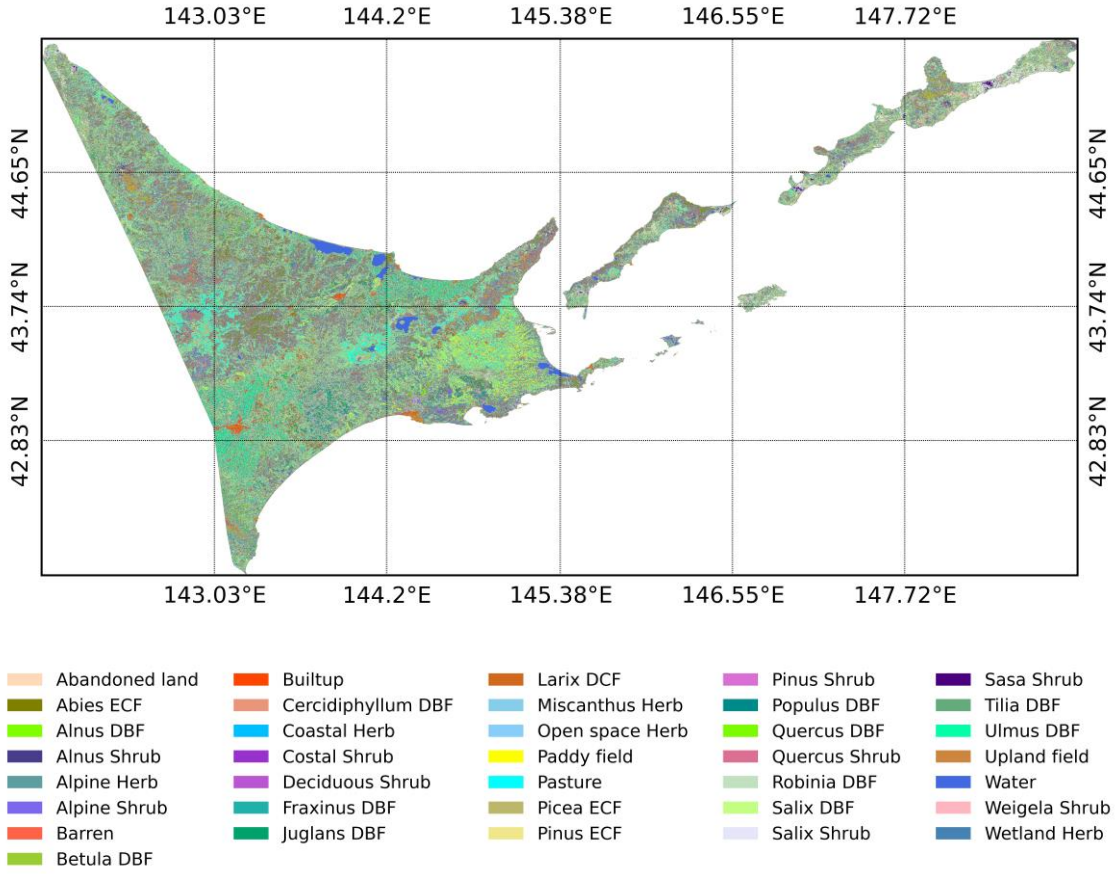
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.12. HokkaidoA prefecture GPE map



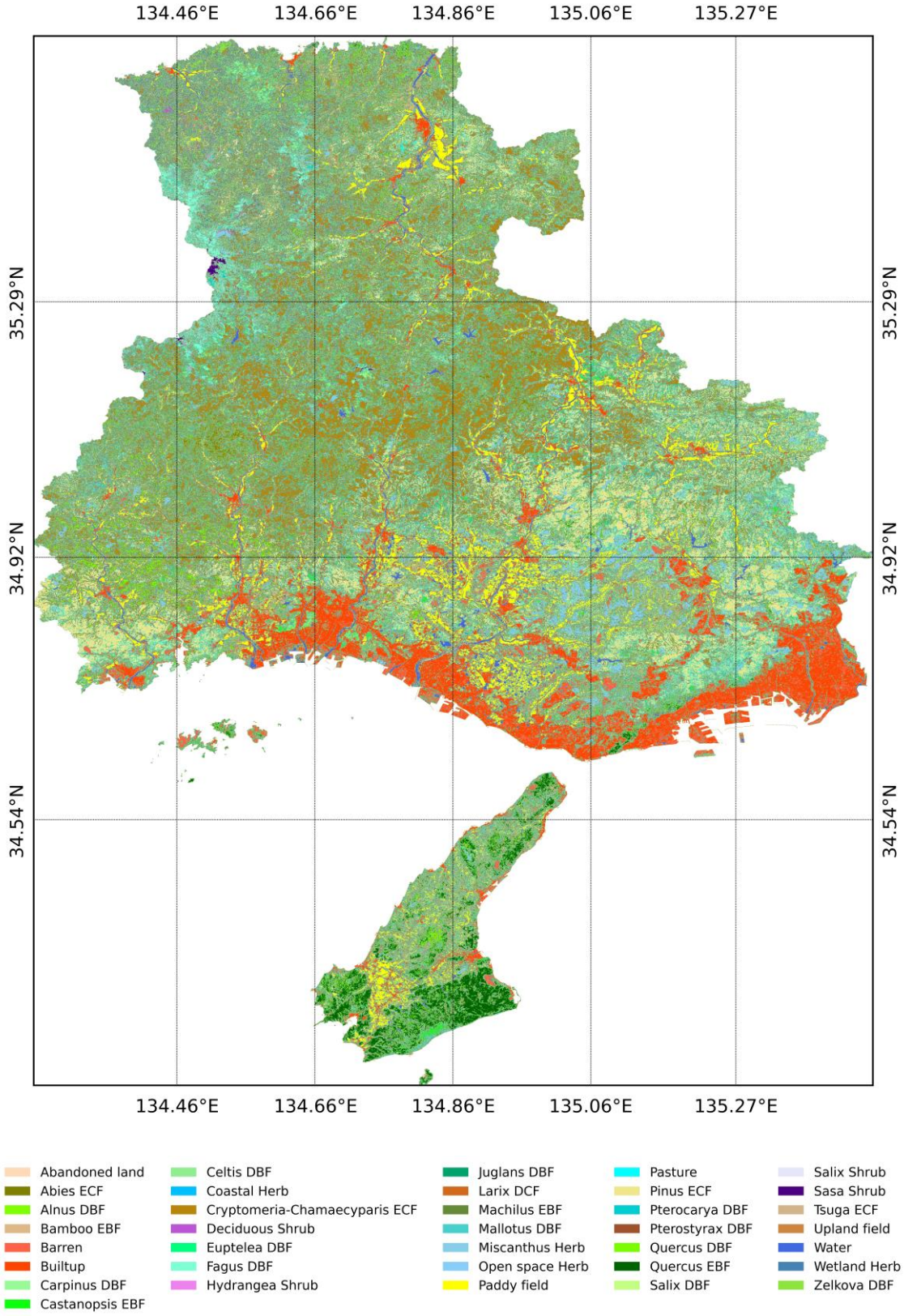
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.13. HokkaidoB prefecture GPE map



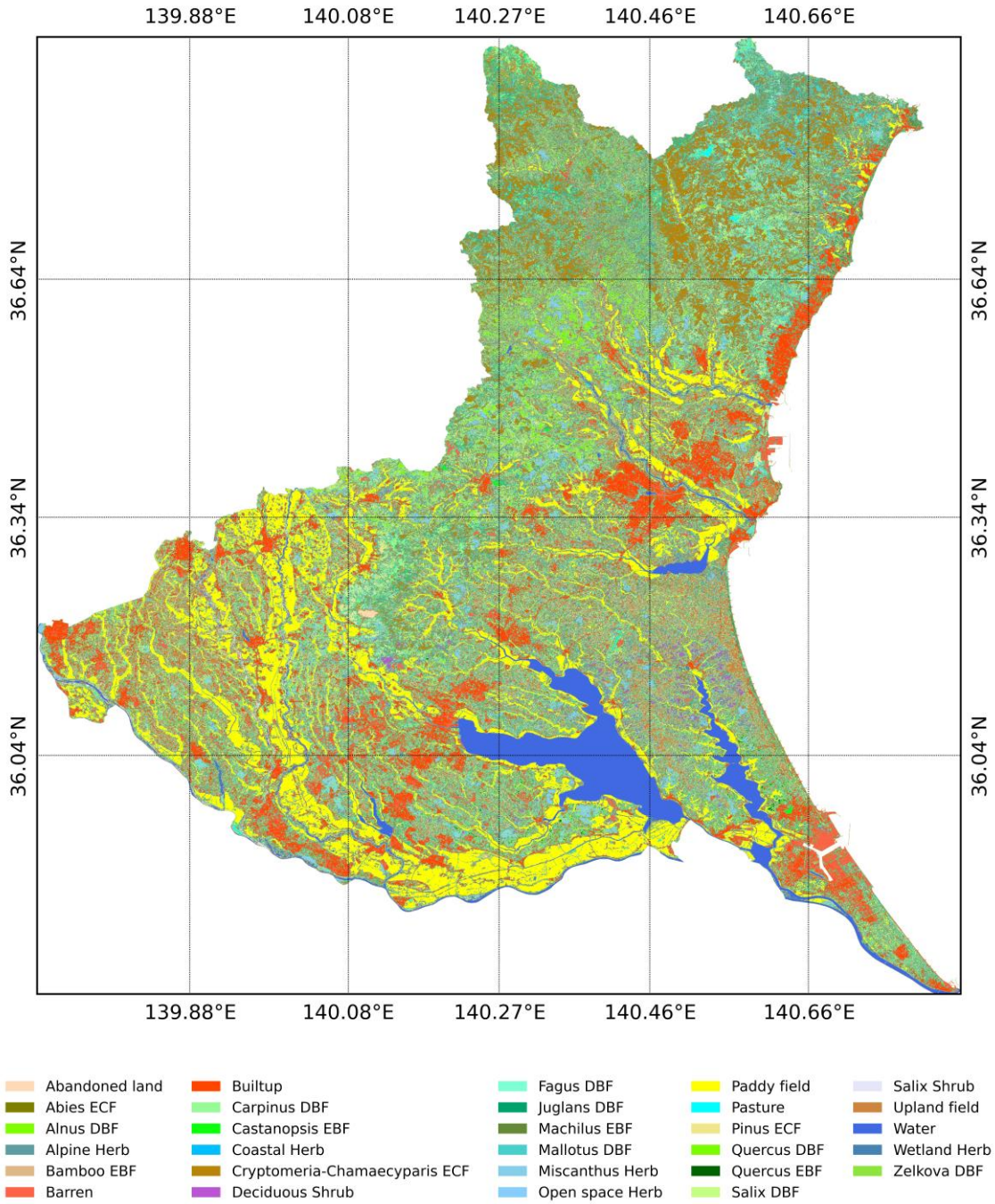
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.14. Hyogo prefecture GPE map



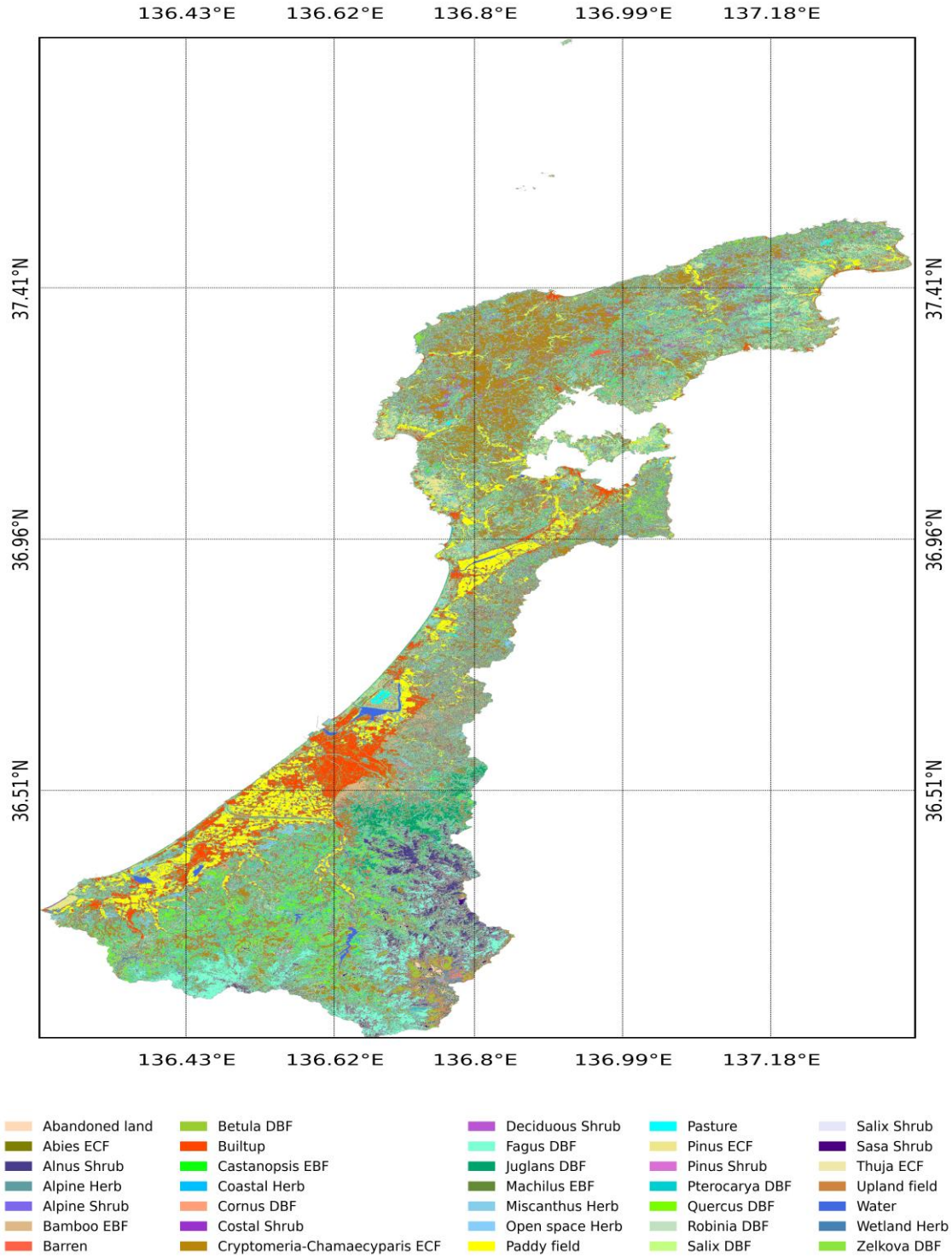
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.15. Ibaraki prefecture GPE map



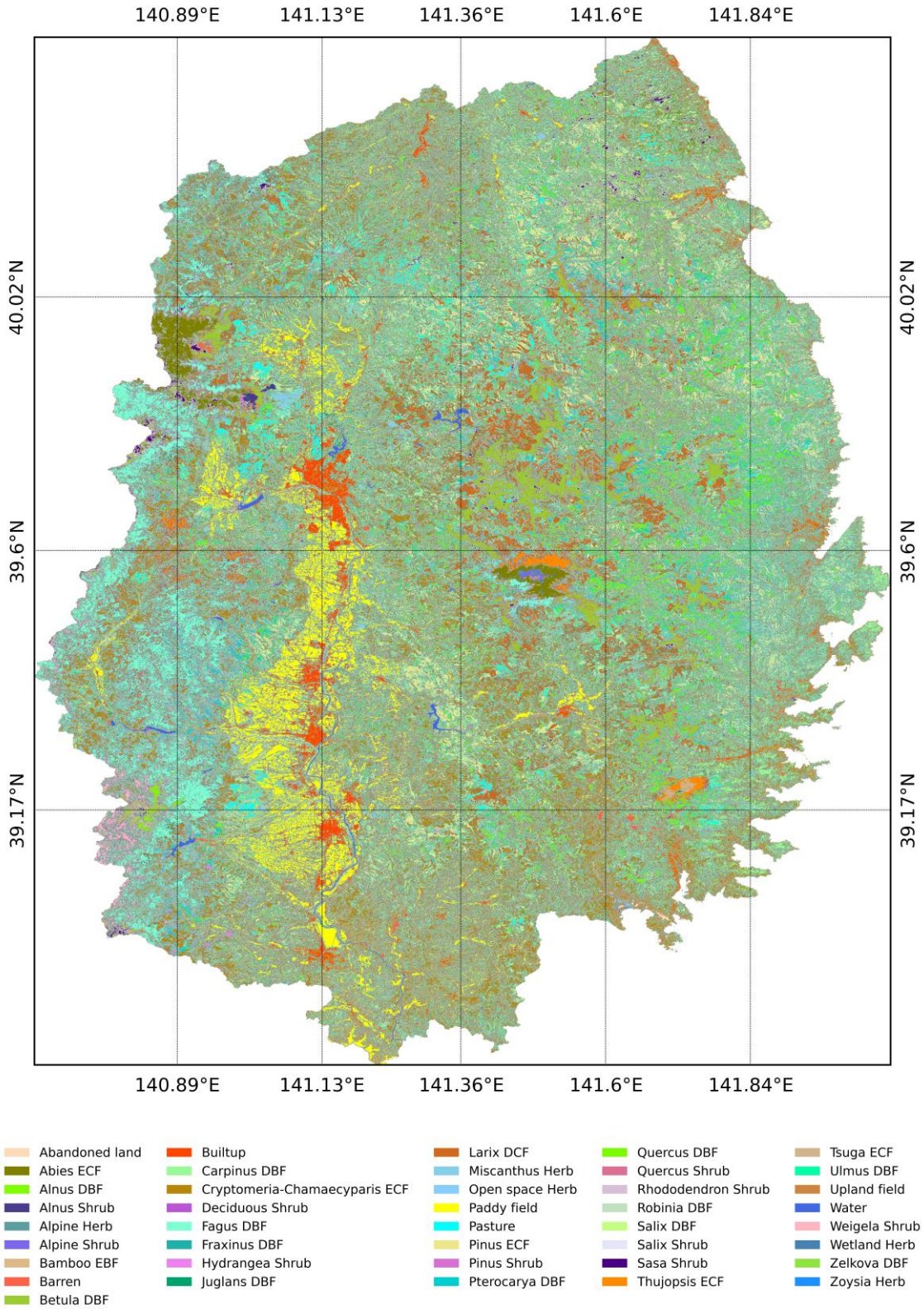
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.16. Ishikawa prefecture GPE map



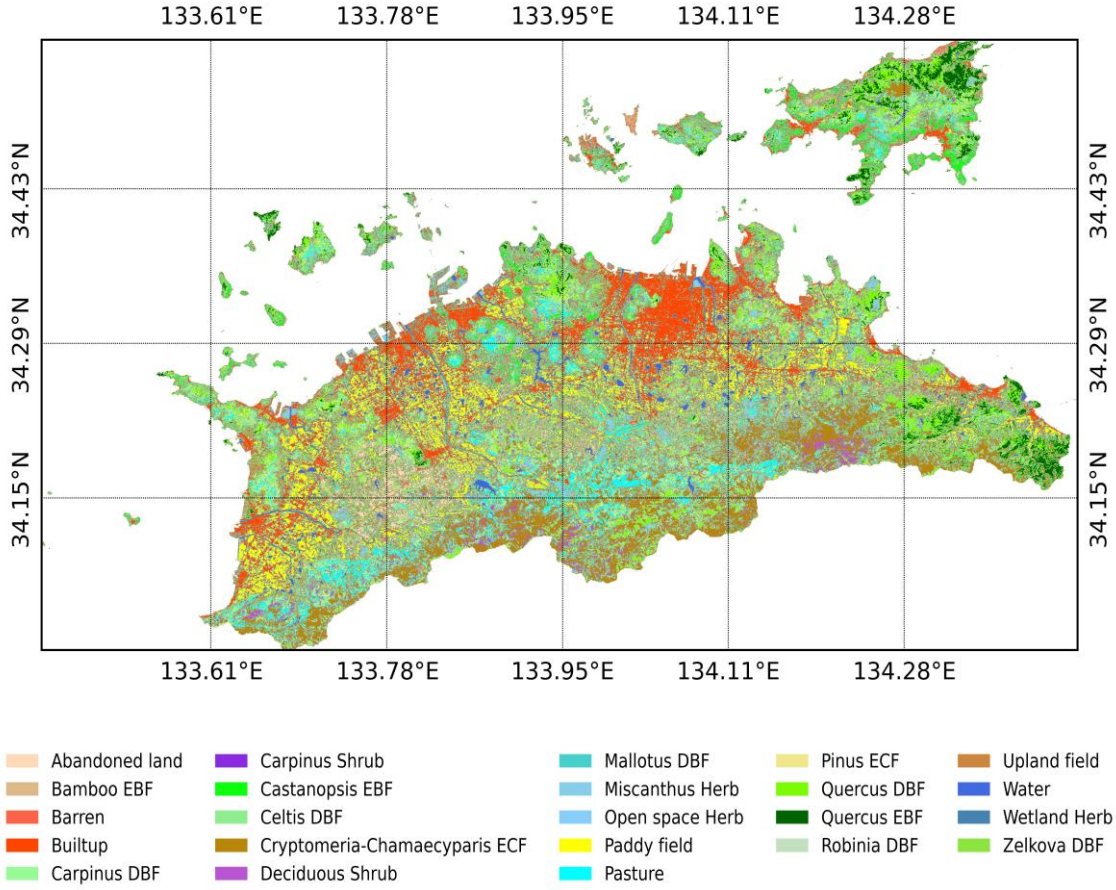
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.17. Iwate prefecture GPE map



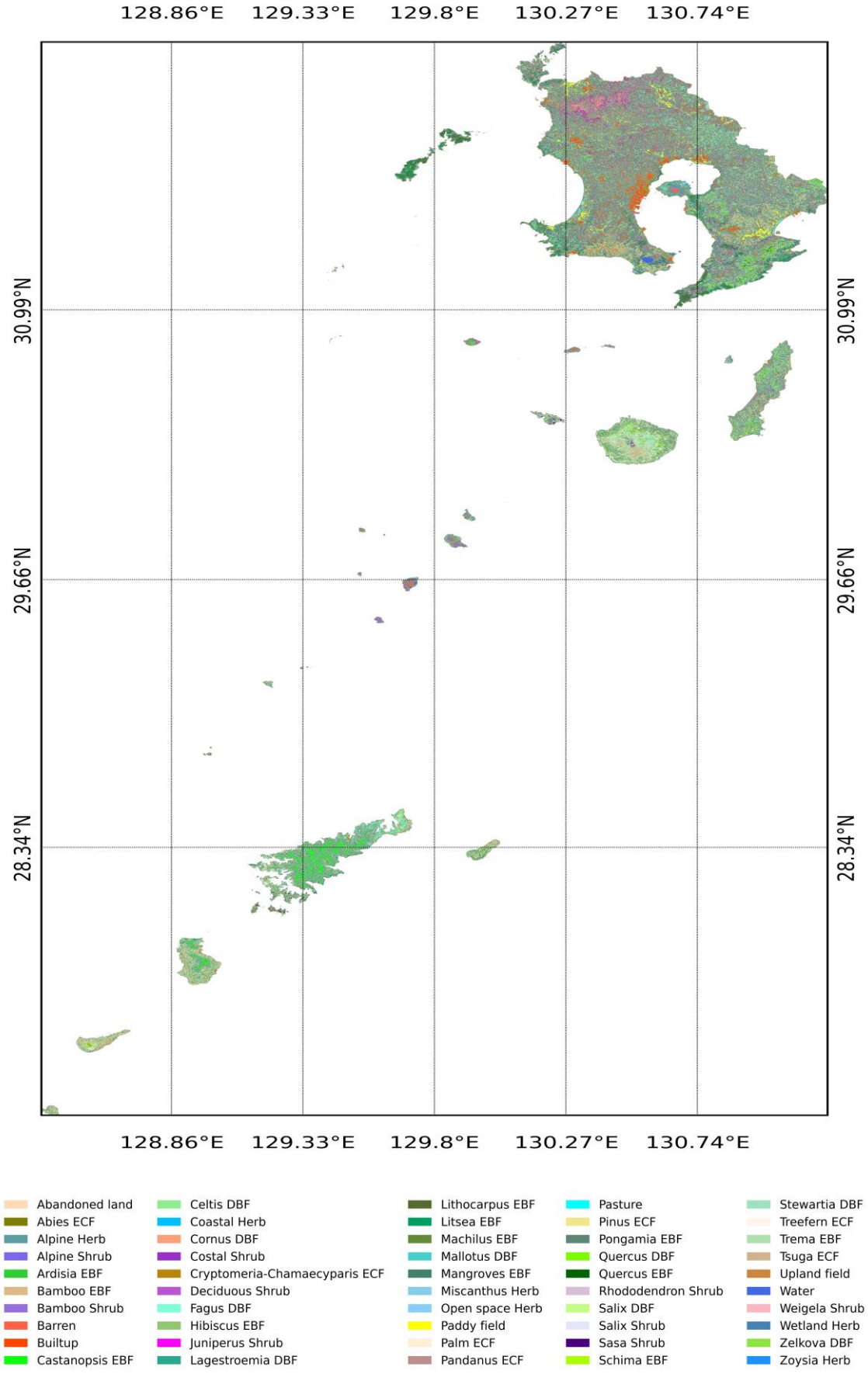
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.18. Kagawa prefecture GPE map



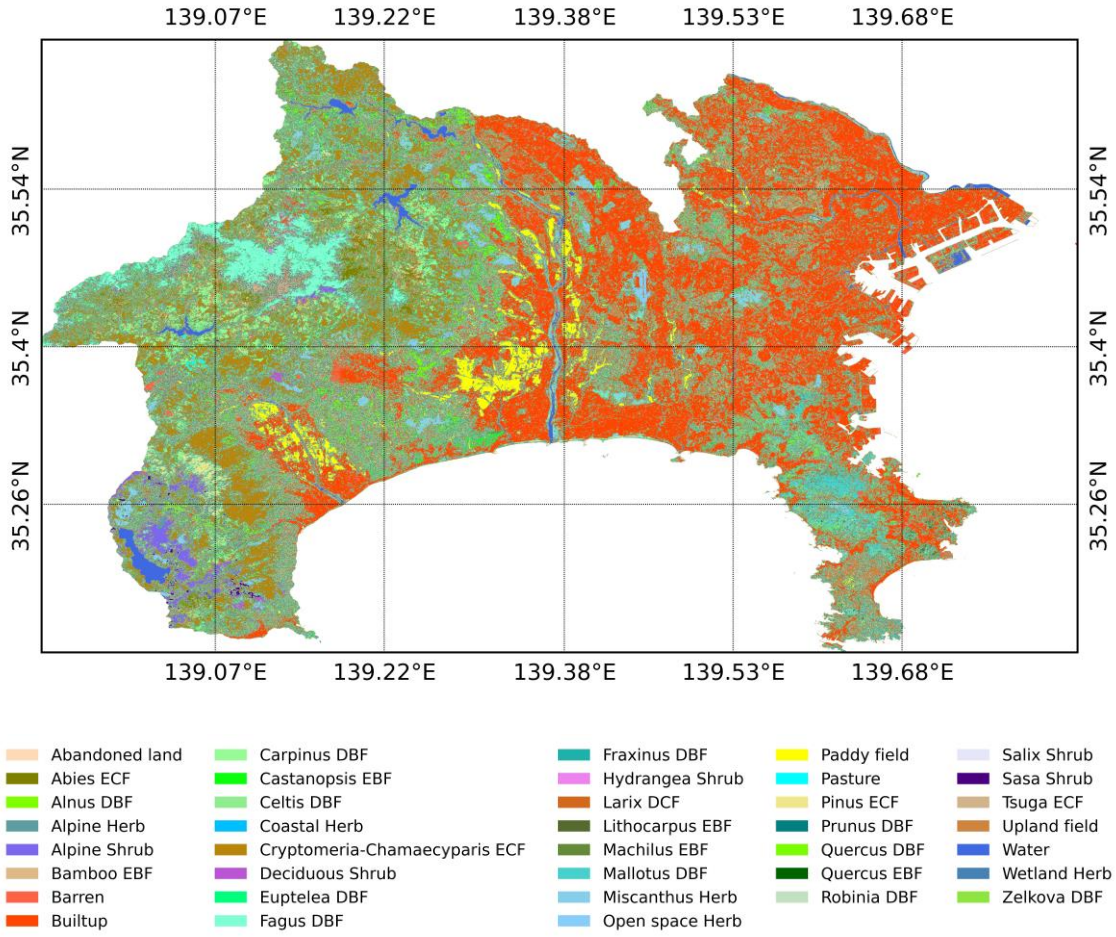
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.19. Kagoshima prefecture GPE map



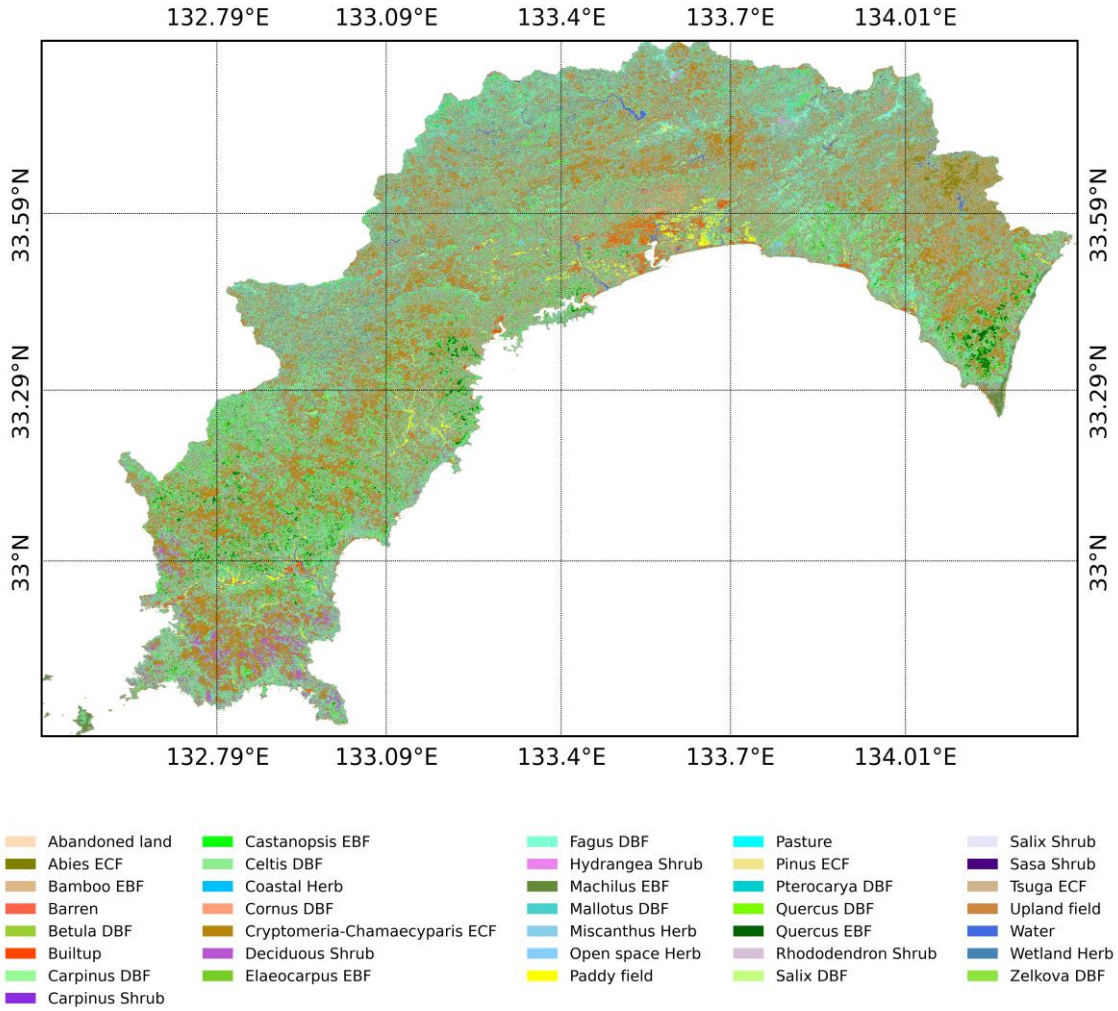
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.20. Kanagawa prefecture GPE map



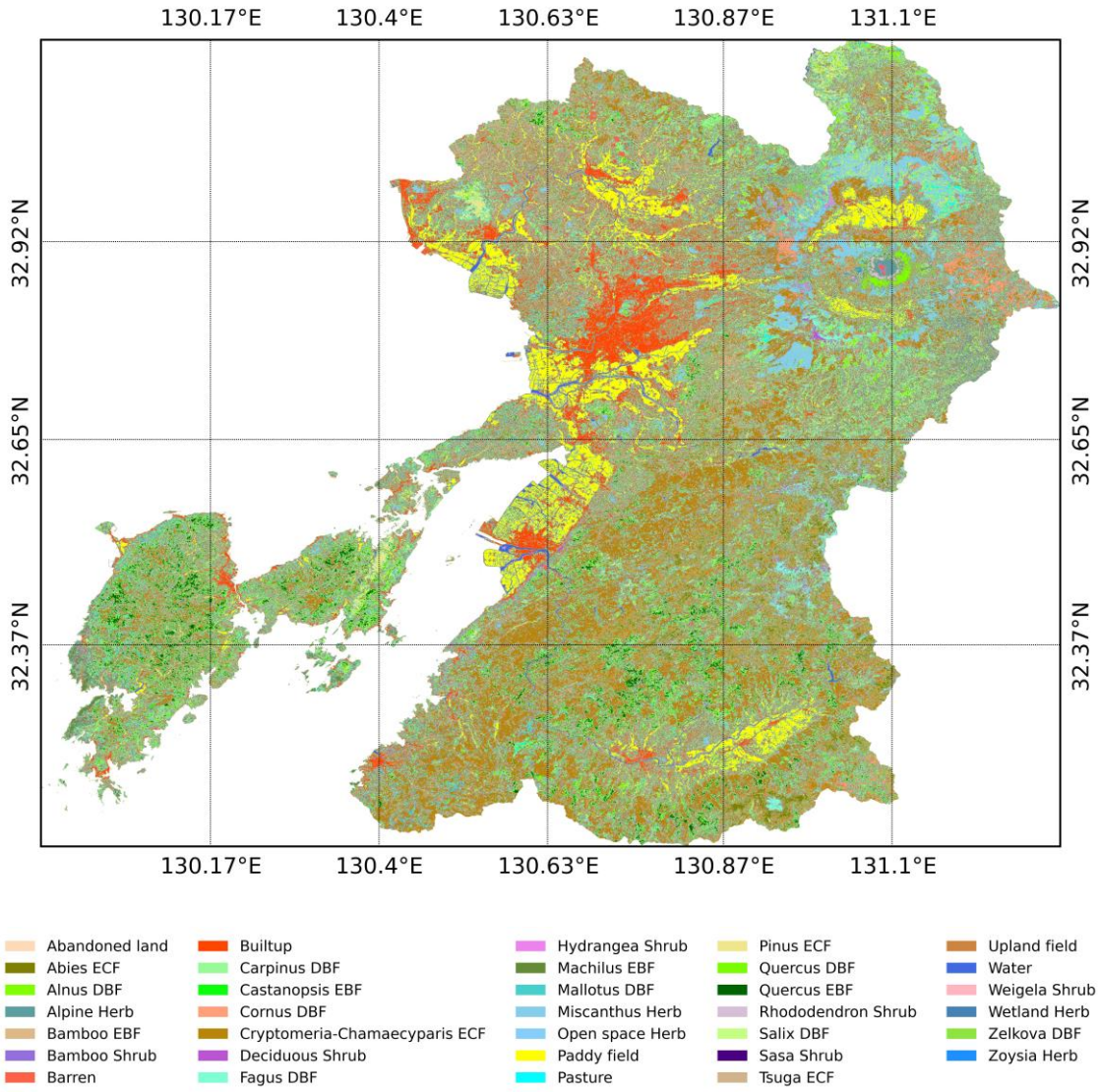
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.21. Kochi prefecture GPE map



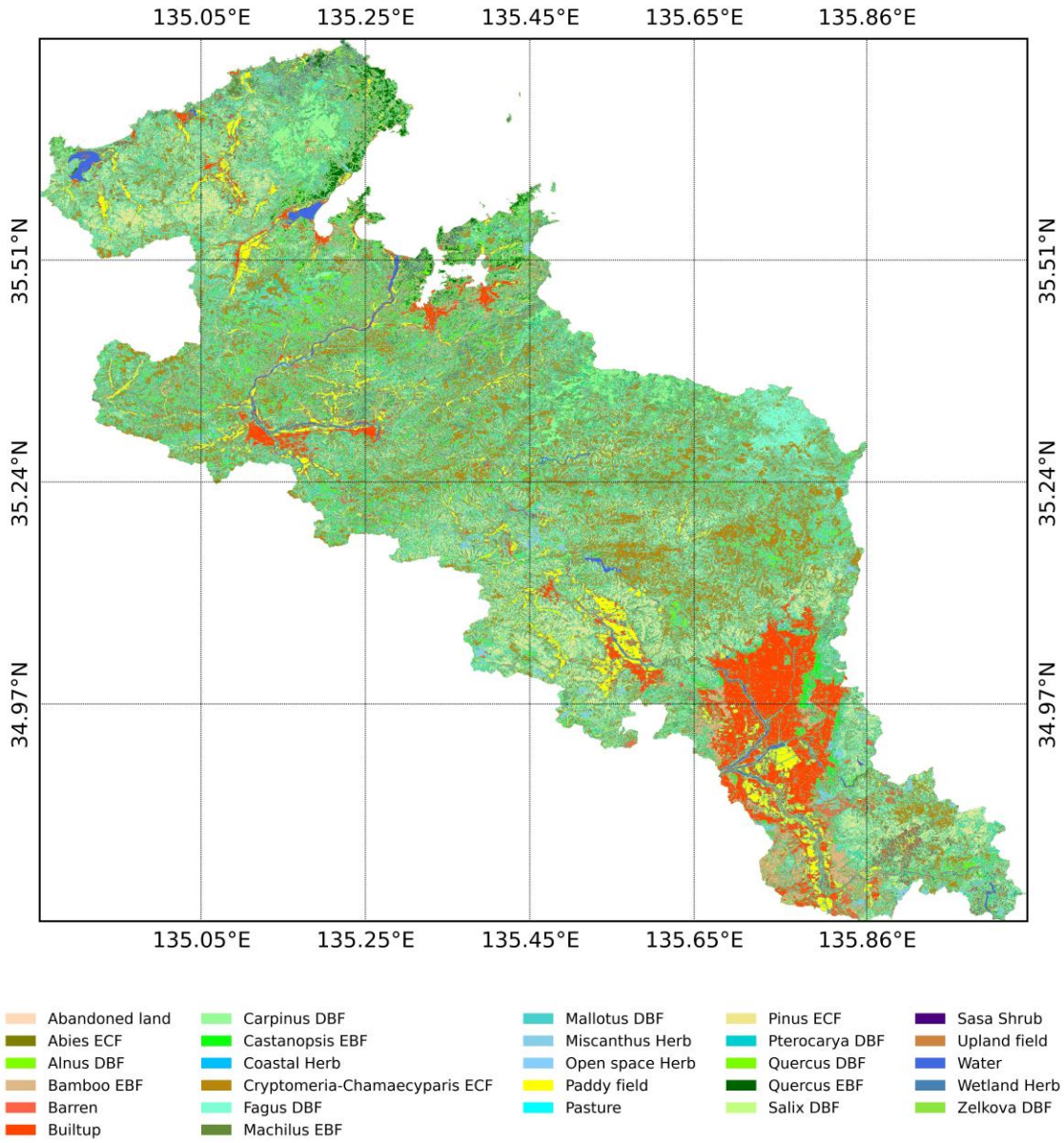
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.22. Kumamoto prefecture GPE map



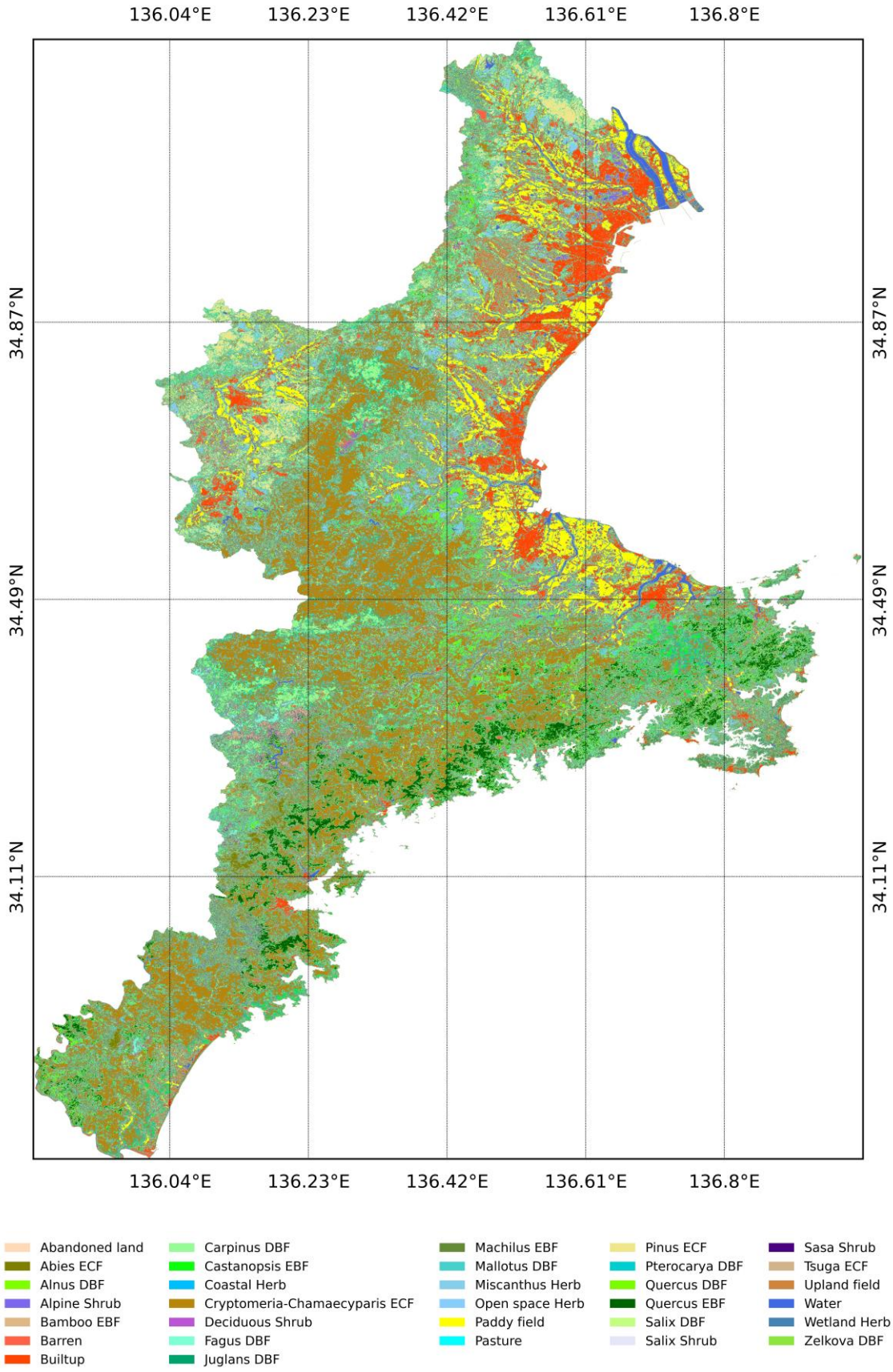
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.23. Kyoto prefecture GPE map



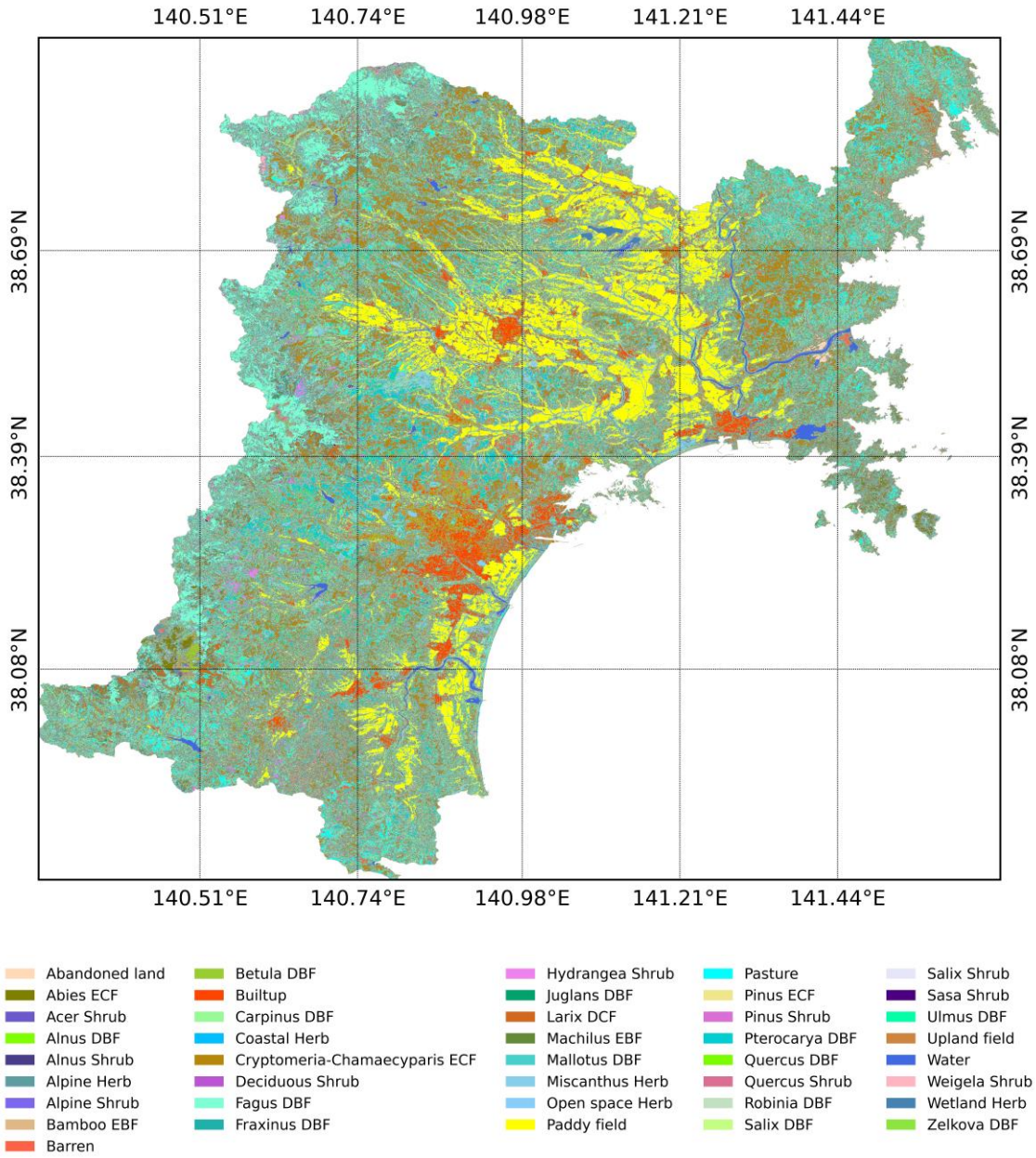
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.24. Mie prefecture GPE map



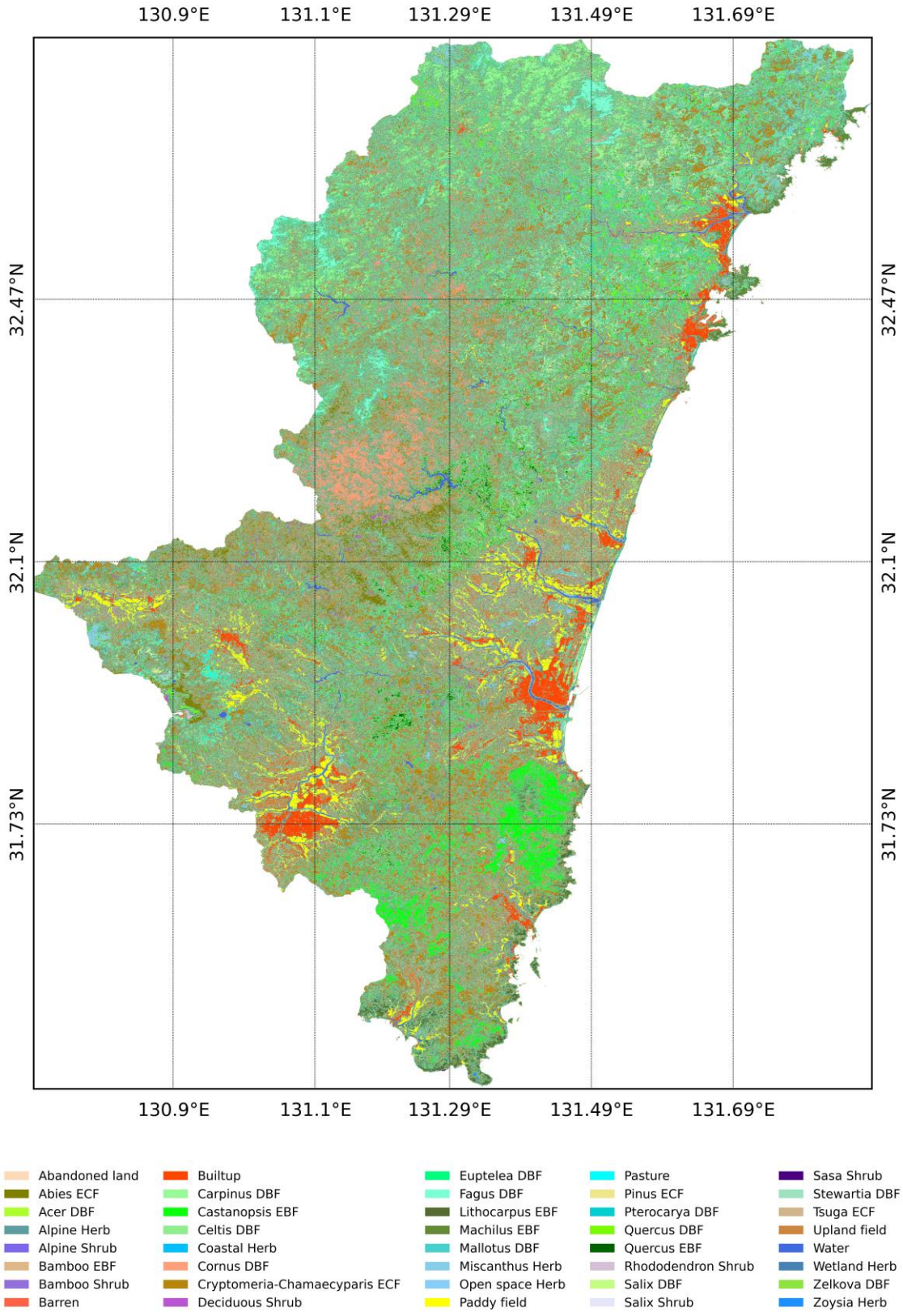
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.25. Miyagi prefecture GPE map



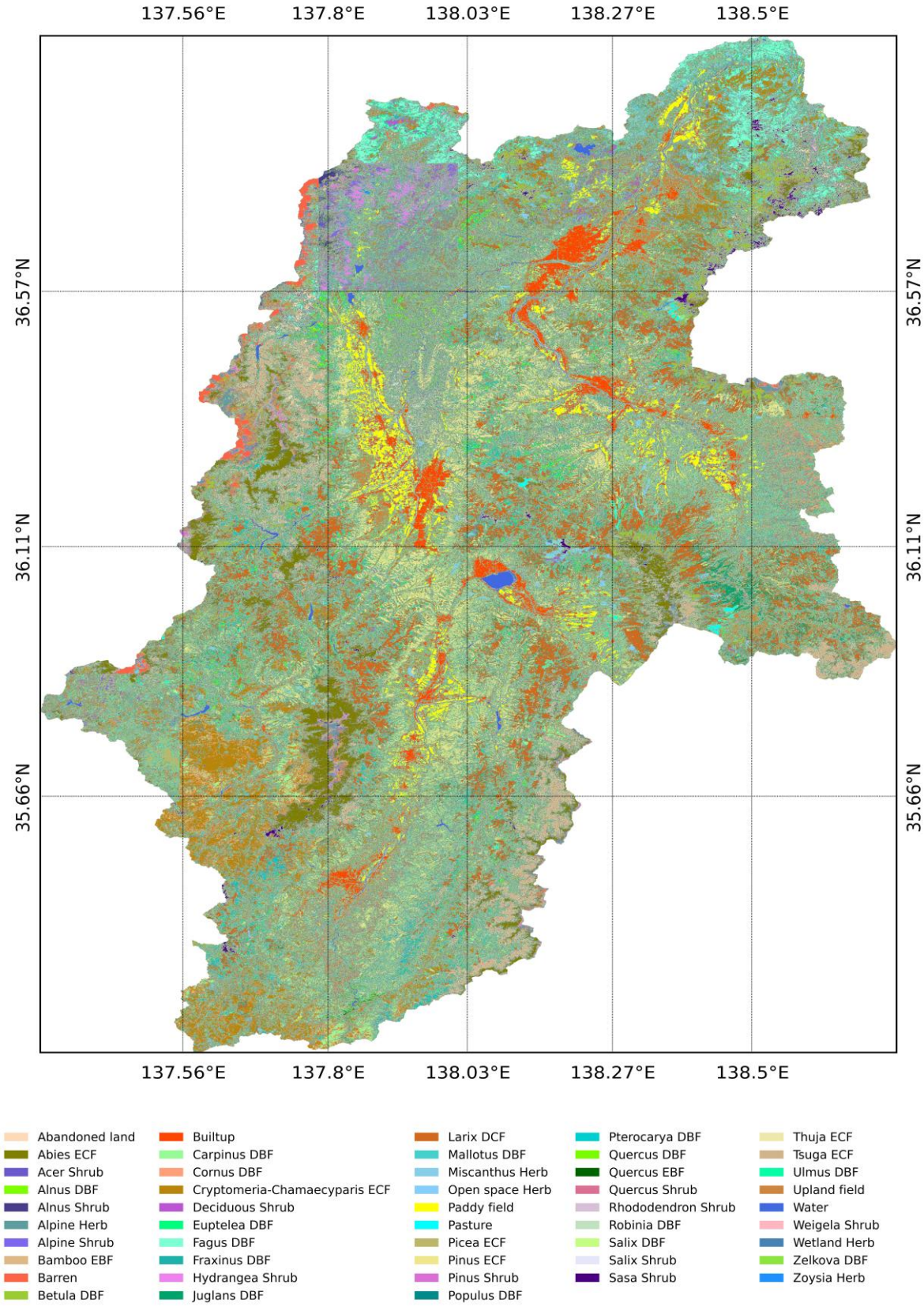
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.26. Miyazaki prefecture GPE map



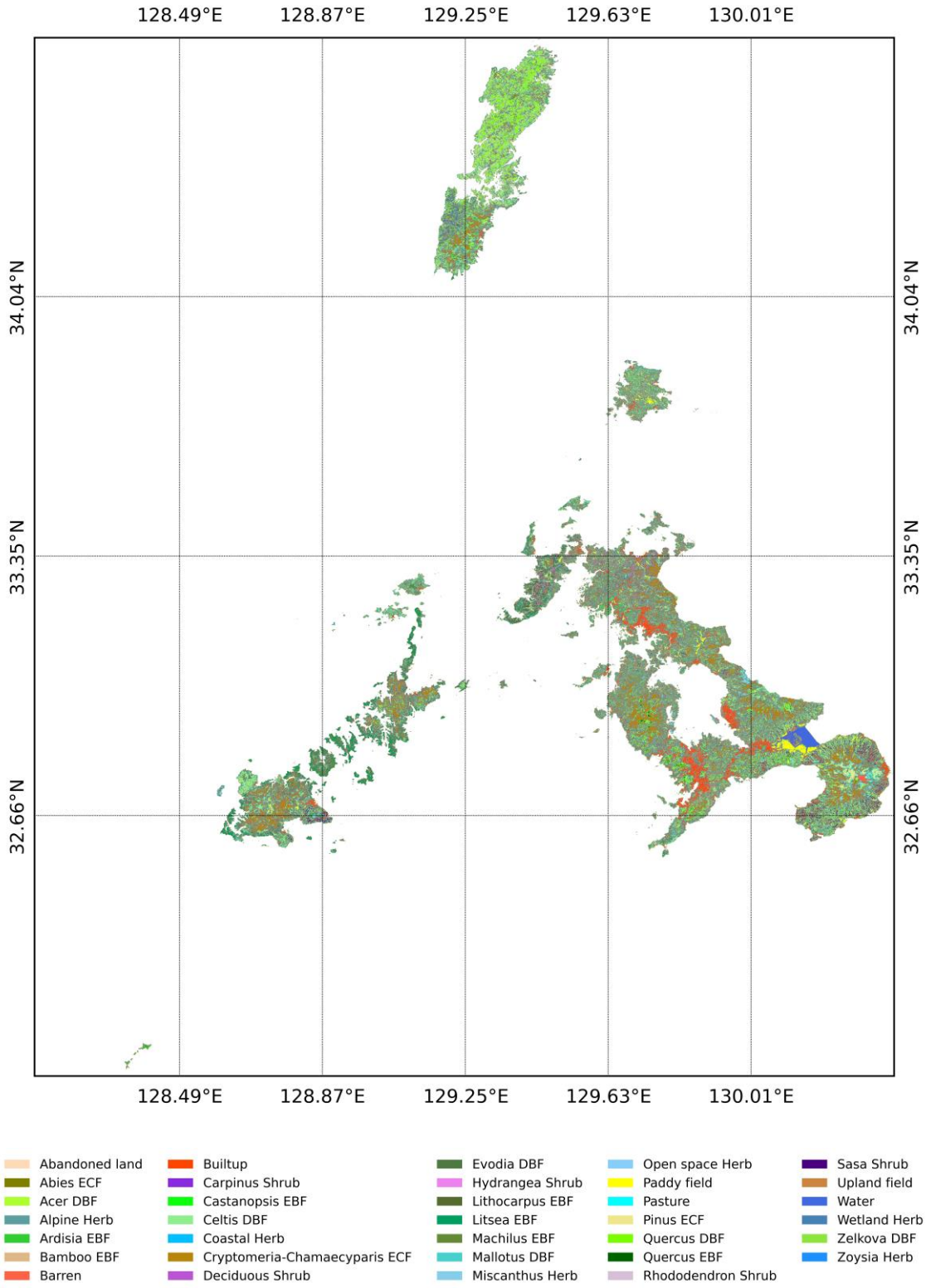
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.27. Nagano prefecture GPE map



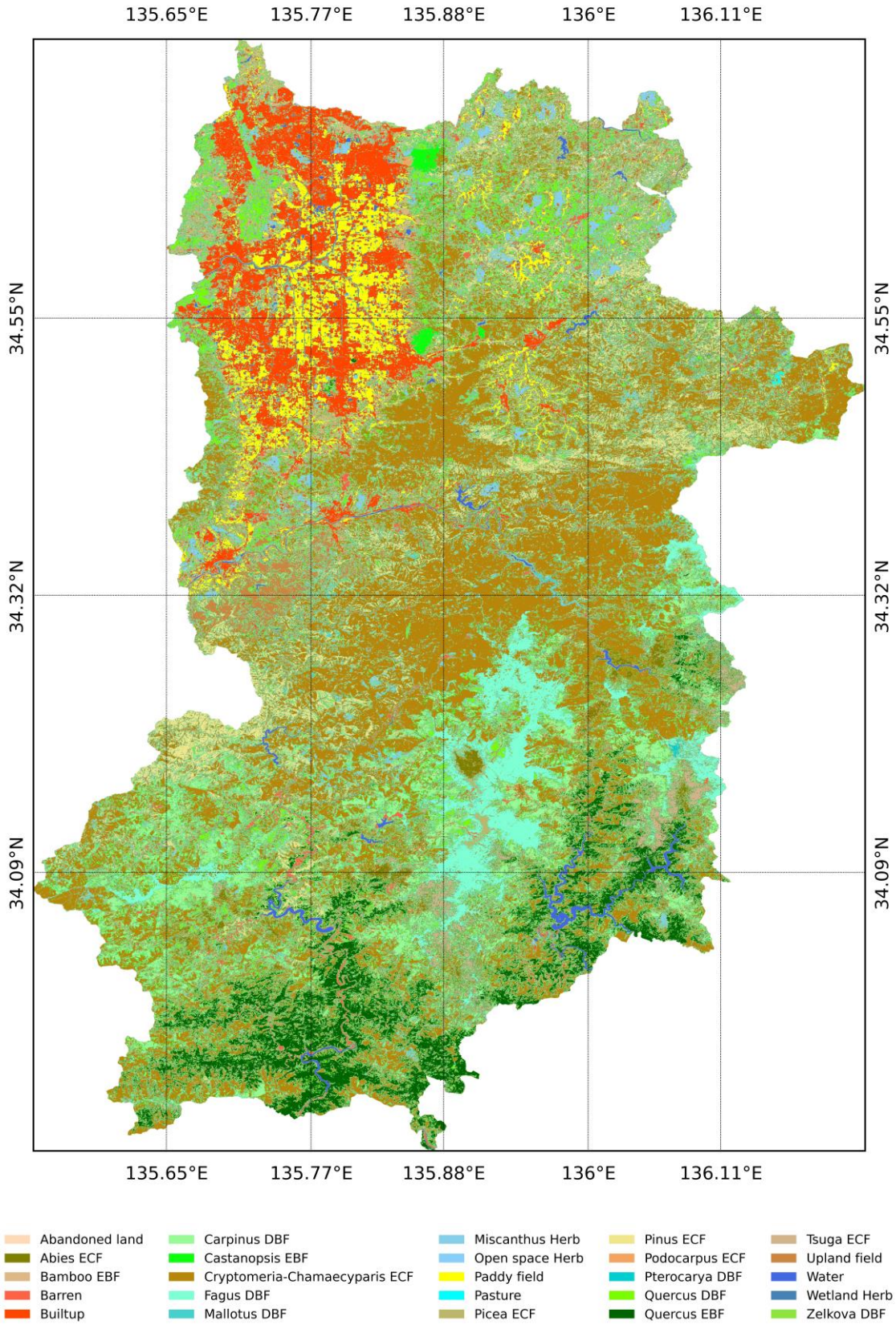
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.28. Nagasaki prefecture GPE map



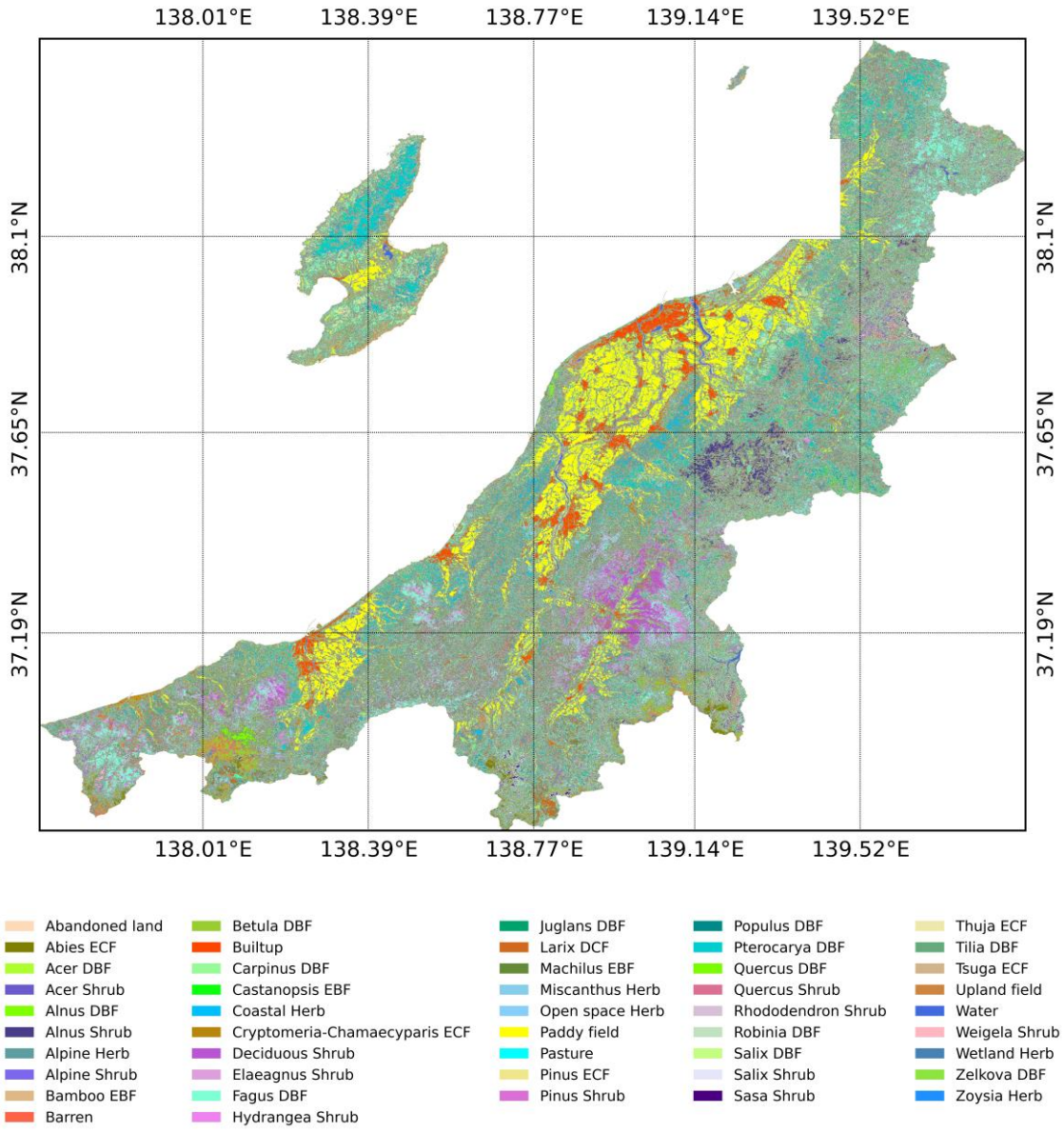
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.29. Nara prefecture GPE map



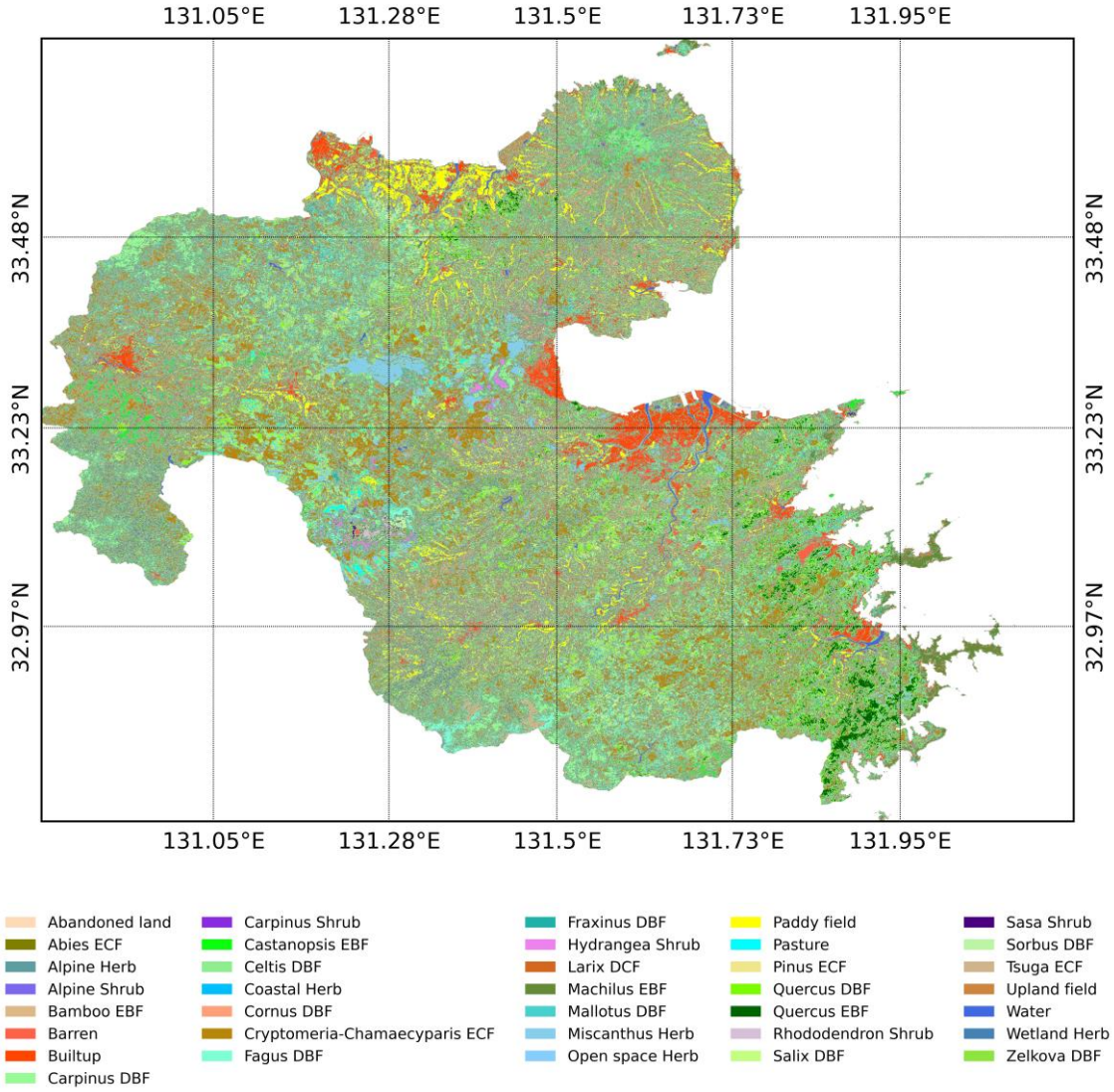
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.30. Niigata prefecture GPE map



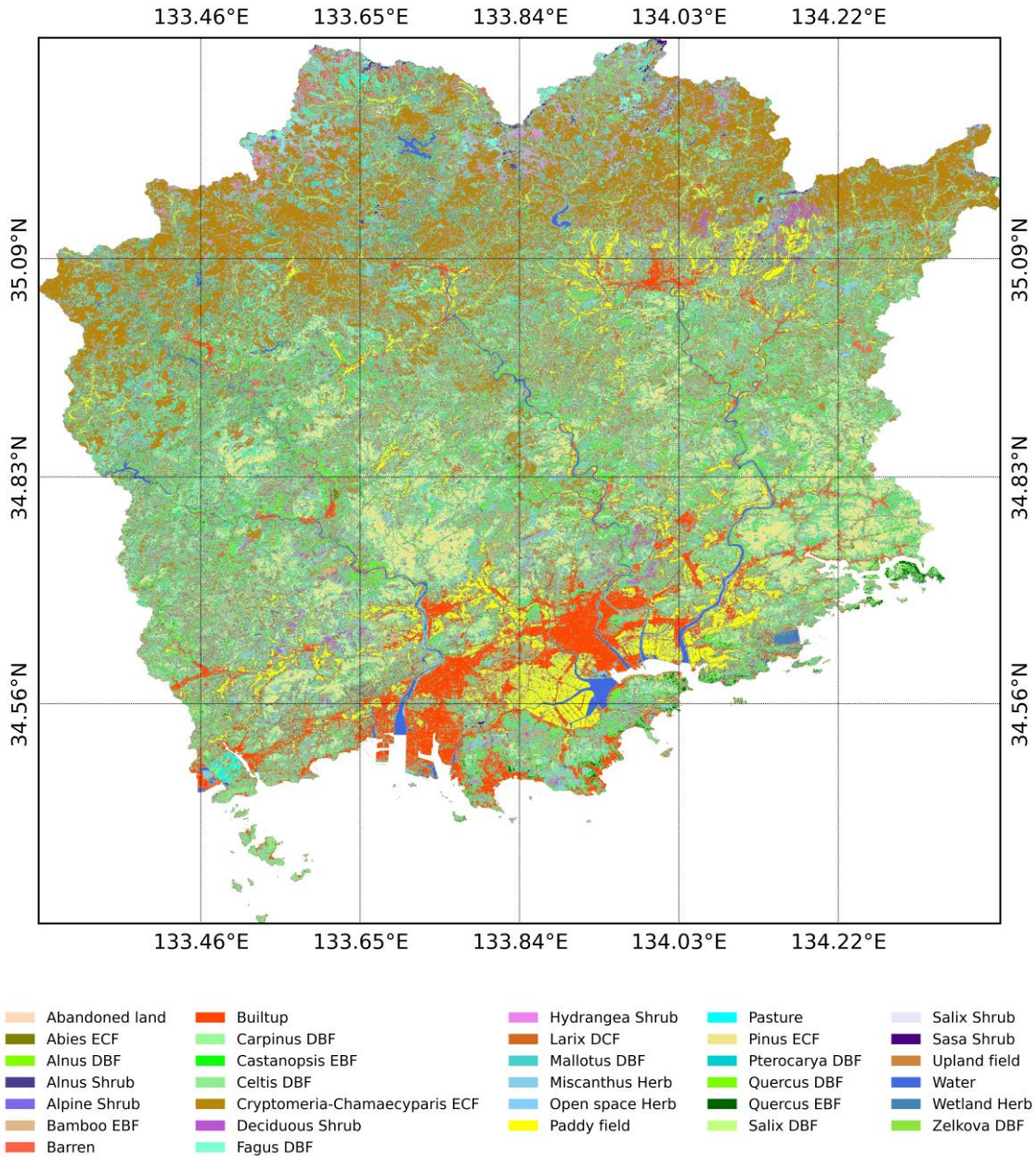
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.31. Oita prefecture GPE map



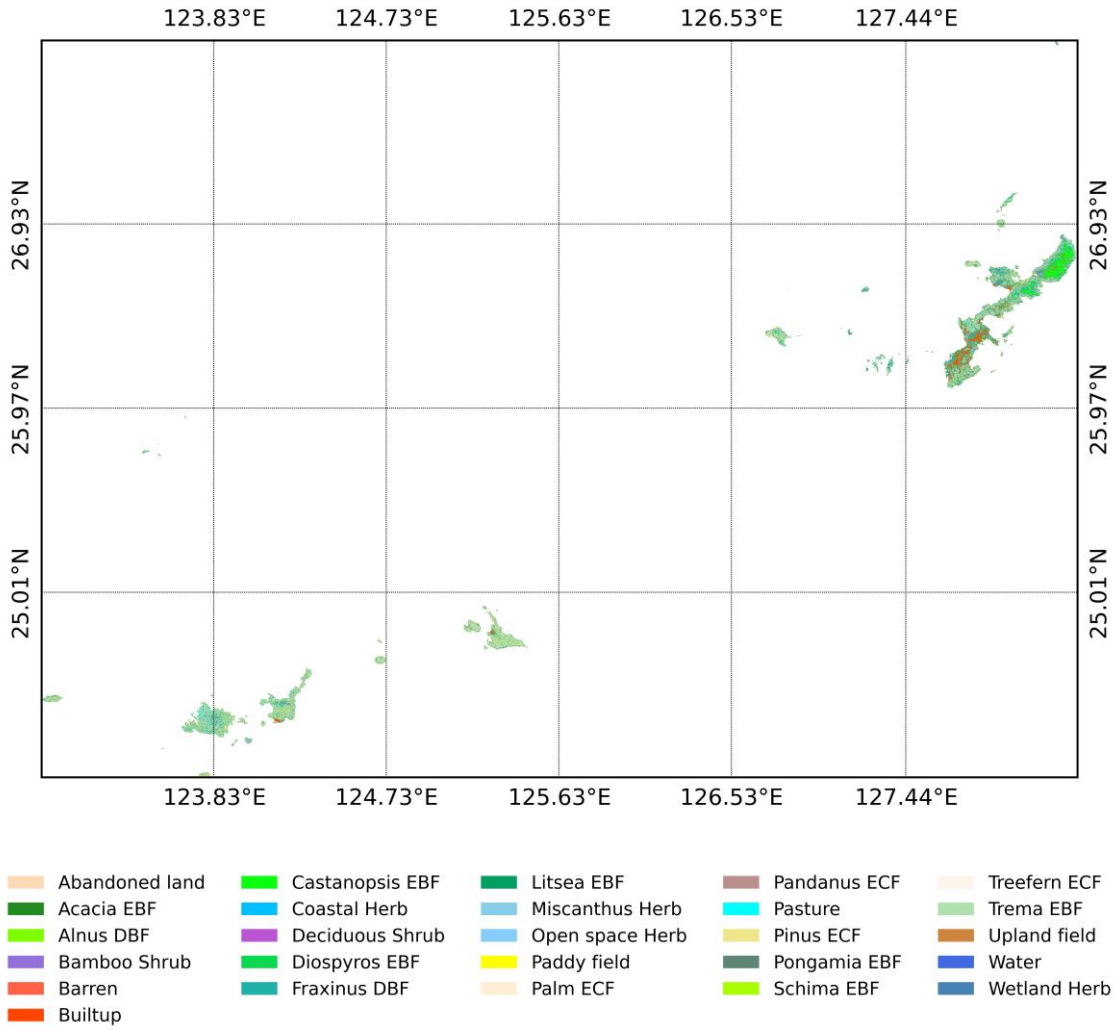
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.32. Okayama prefecture GPE map



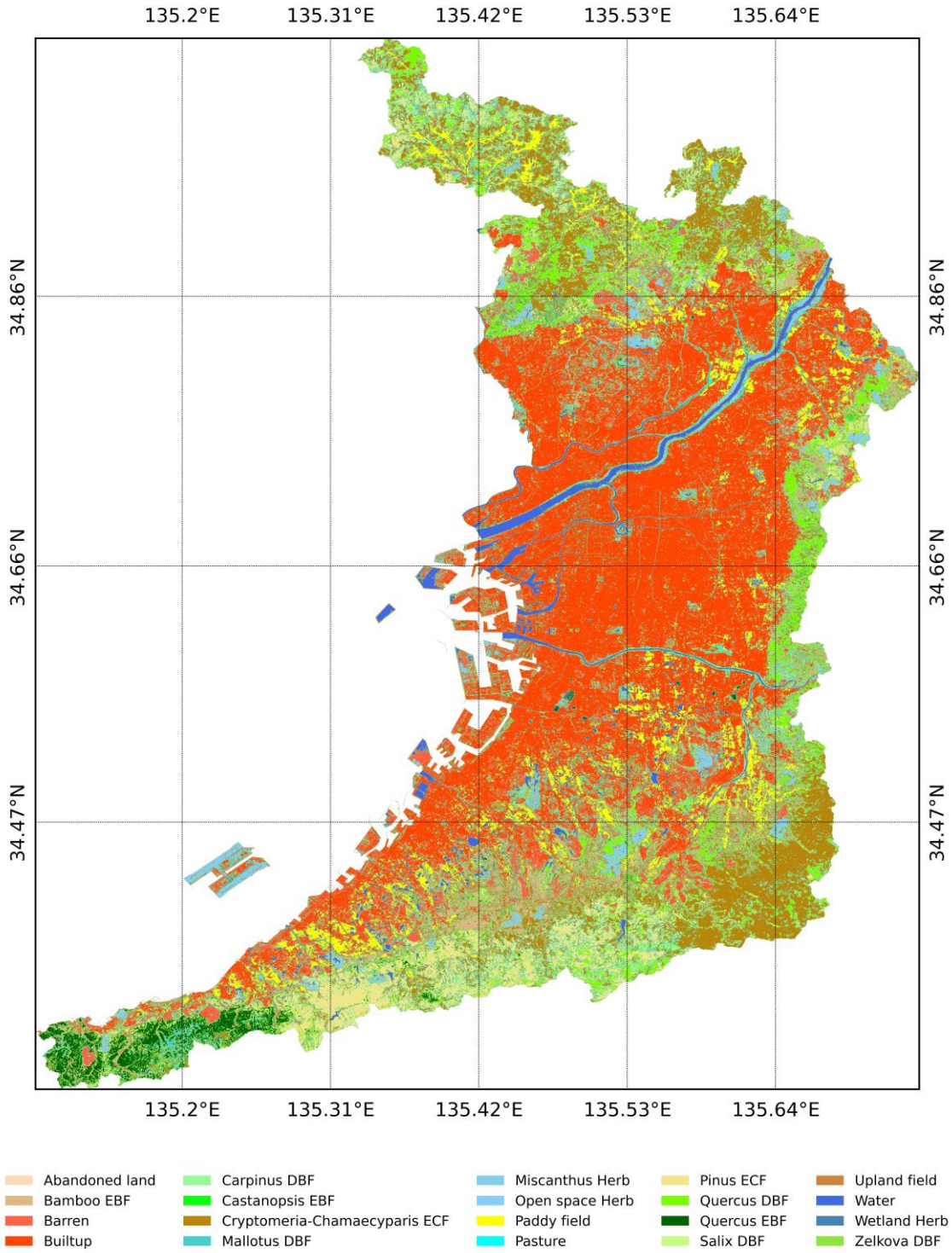
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.33. Okinawa prefecture GPE map



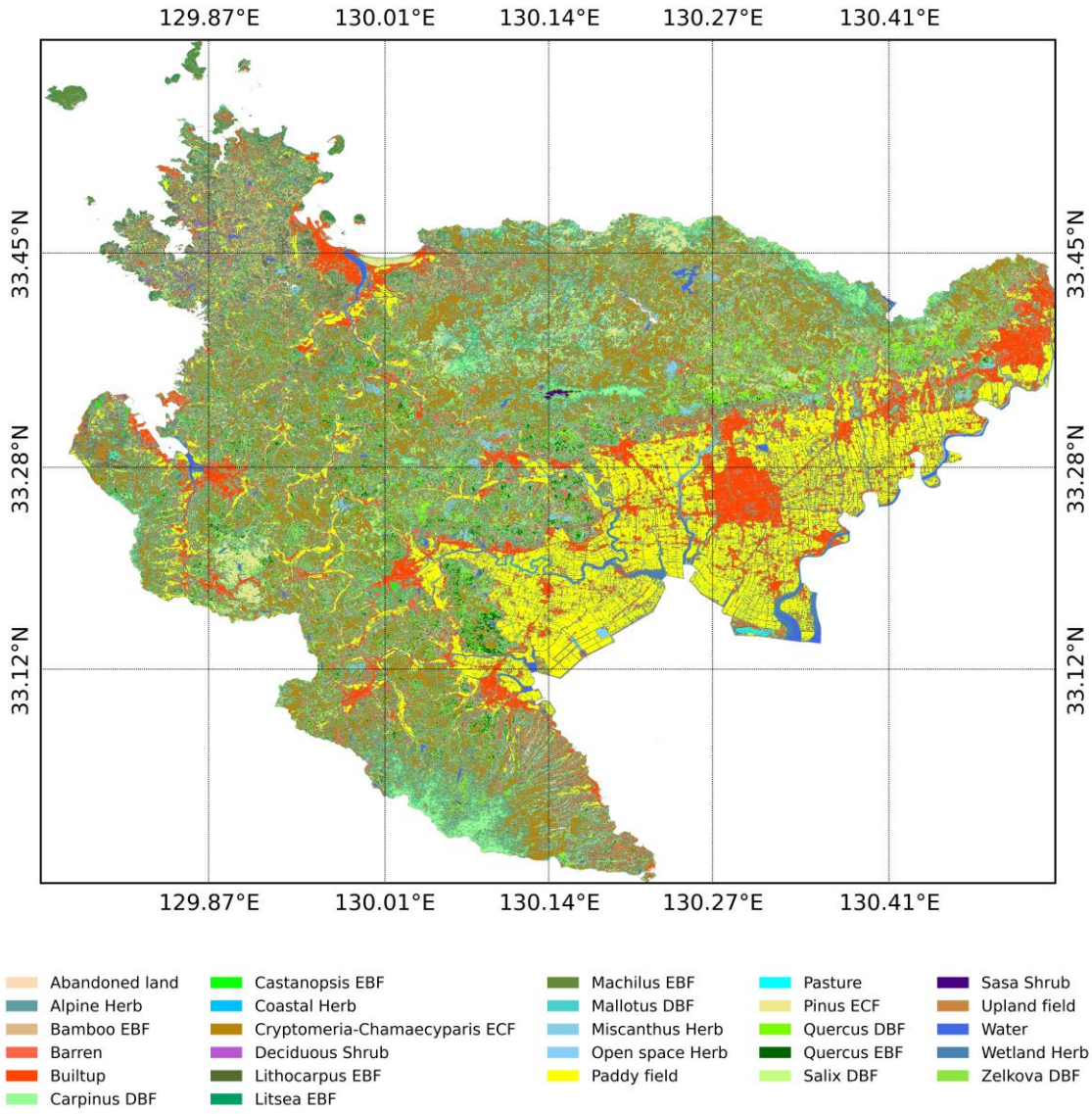
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.34. Osaka prefecture GPE map



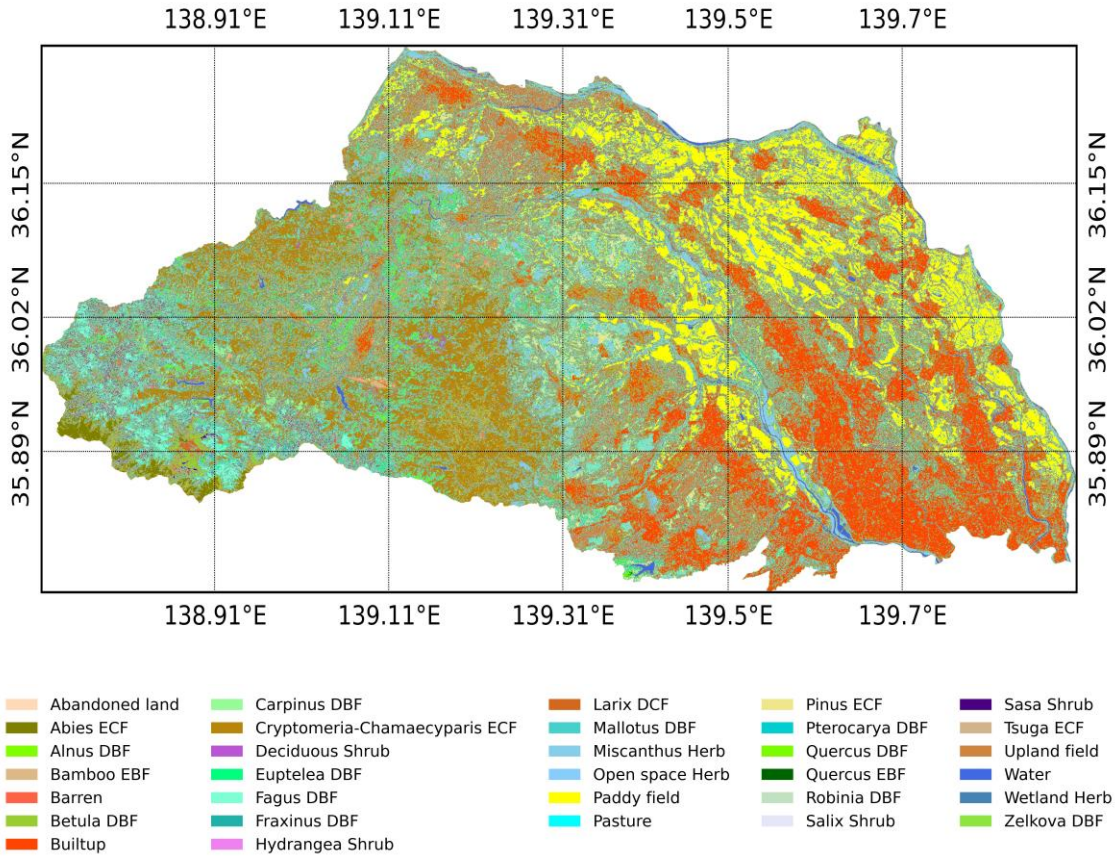
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.35. Saga prefecture GPE map



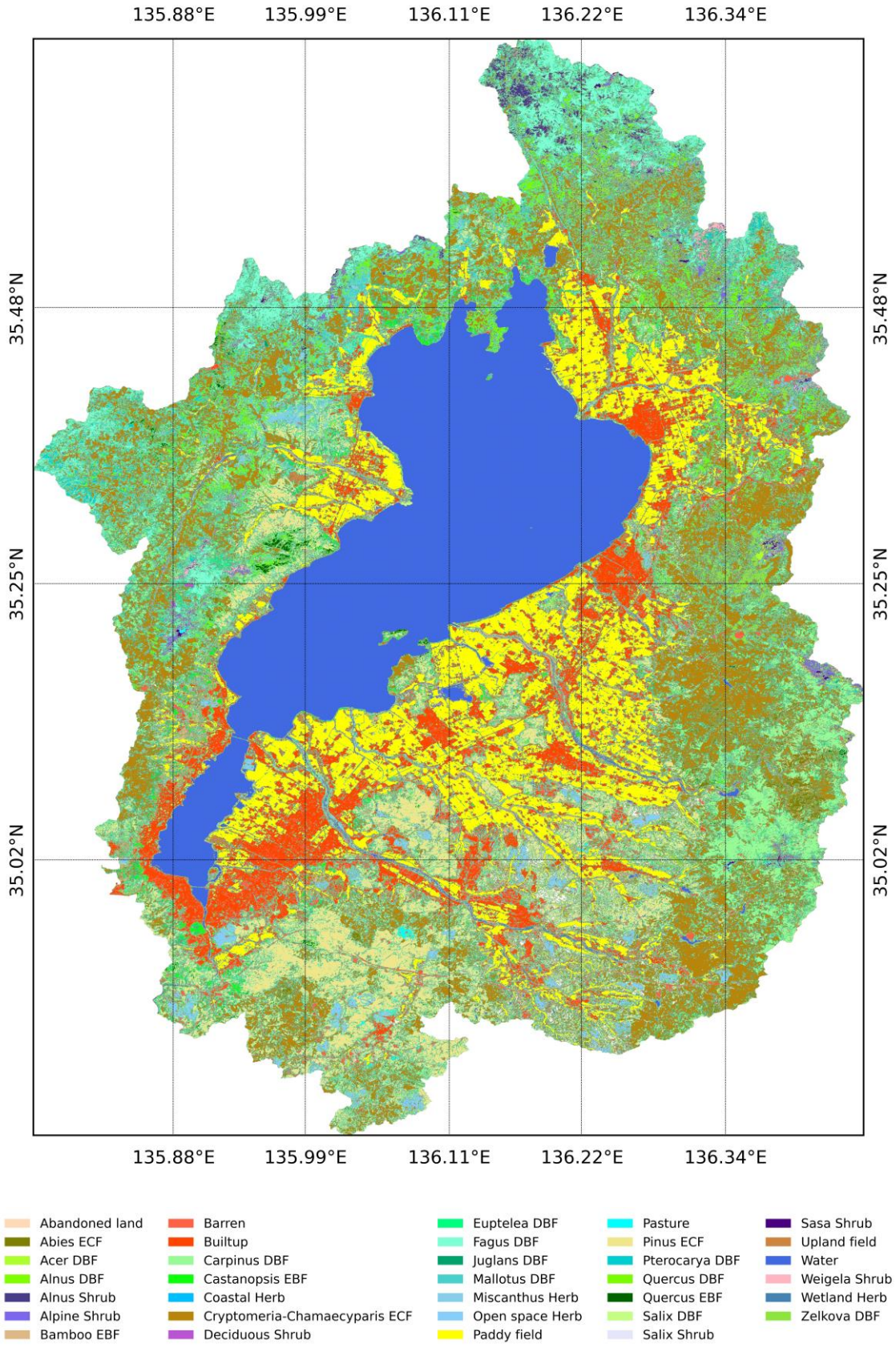
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.36. Saitama prefecture GPE map



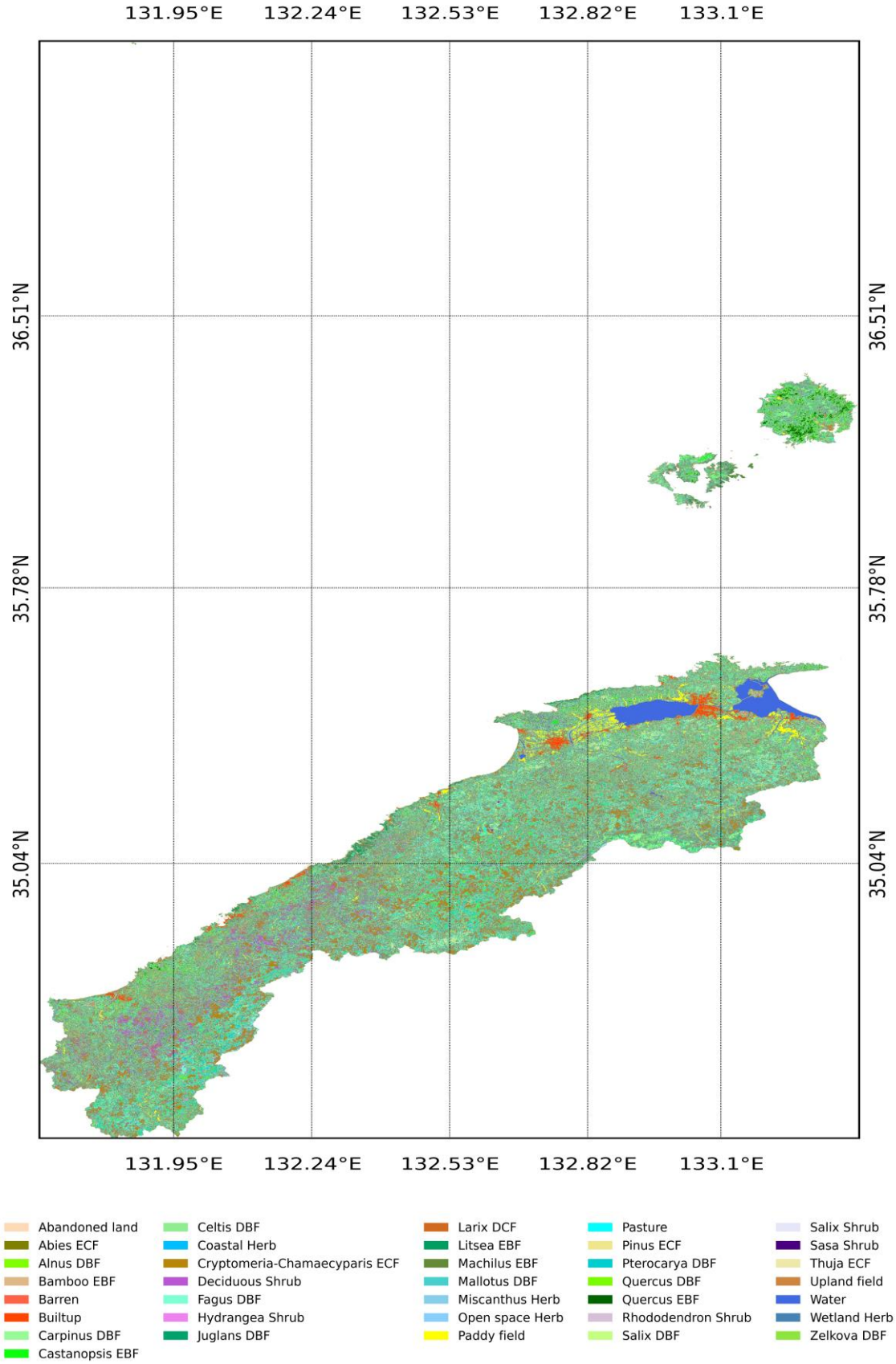
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.37. Shiga prefecture GPE map



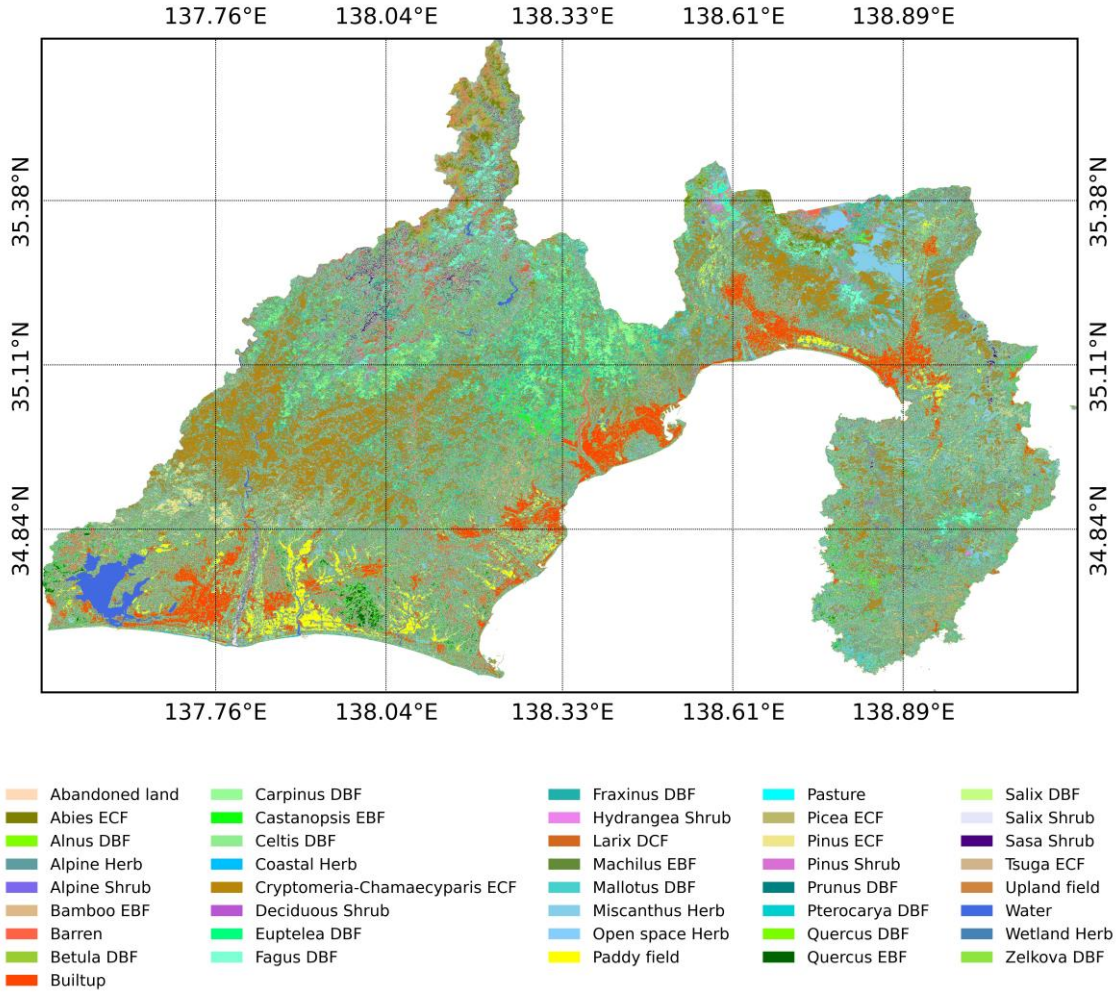
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.38. Shimane prefecture GPE map



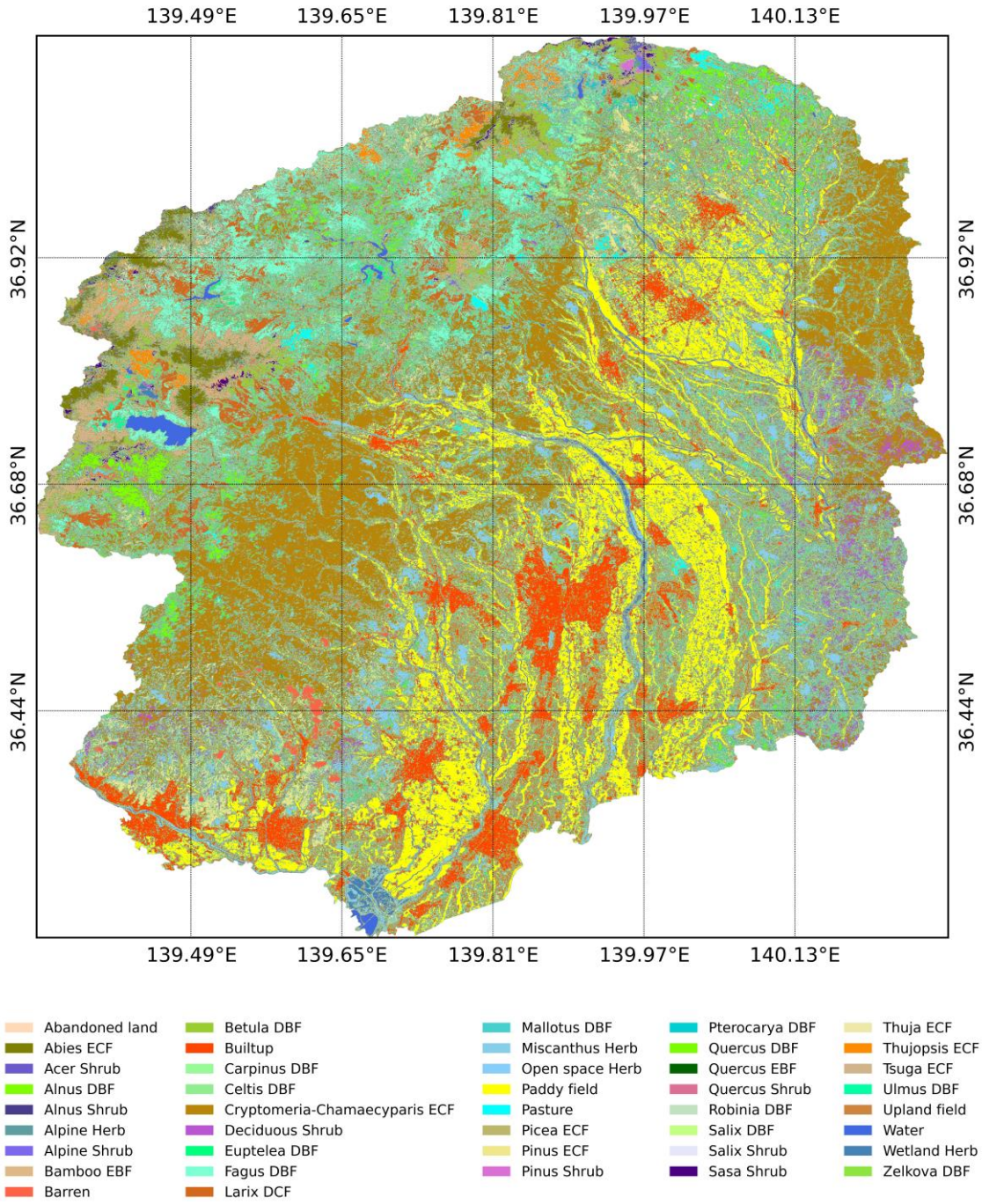
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.39. Shizuoka prefecture GPE map



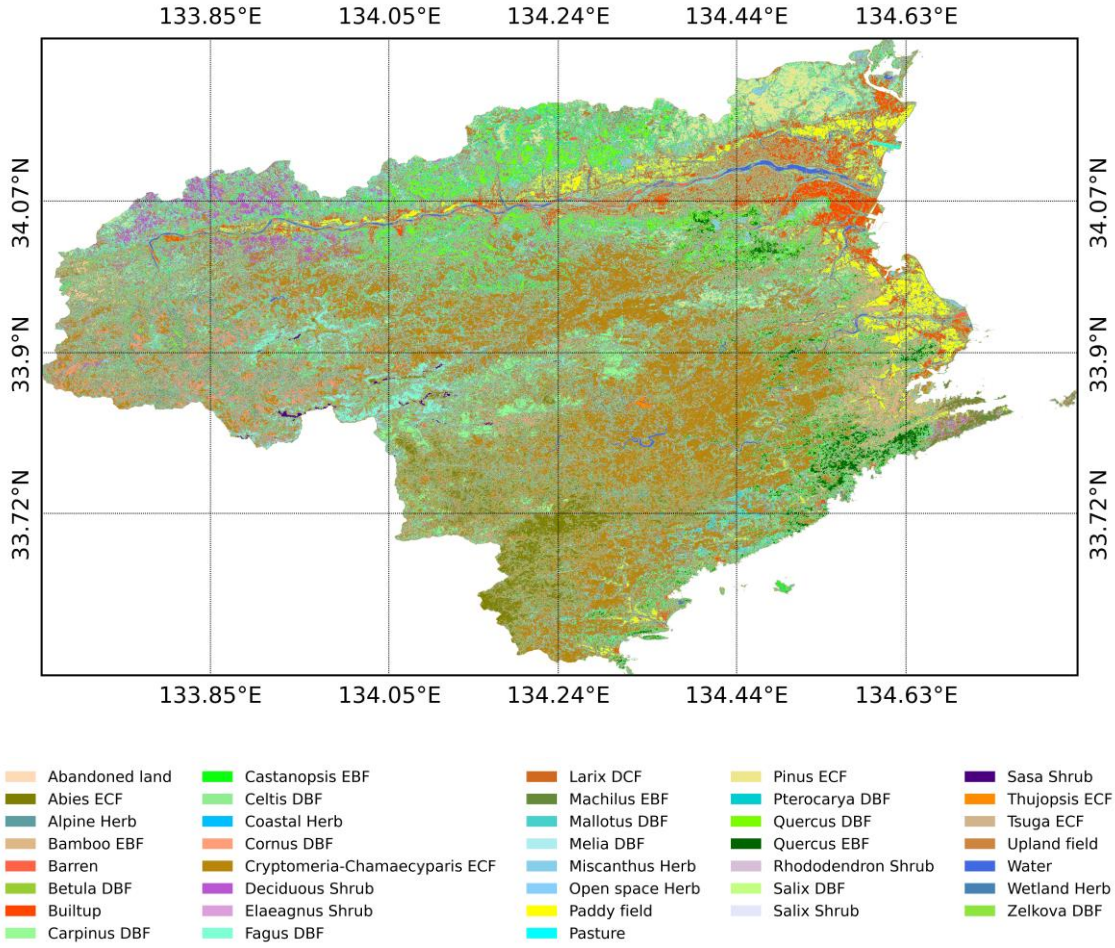
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.40. Tochigi prefecture GPE map



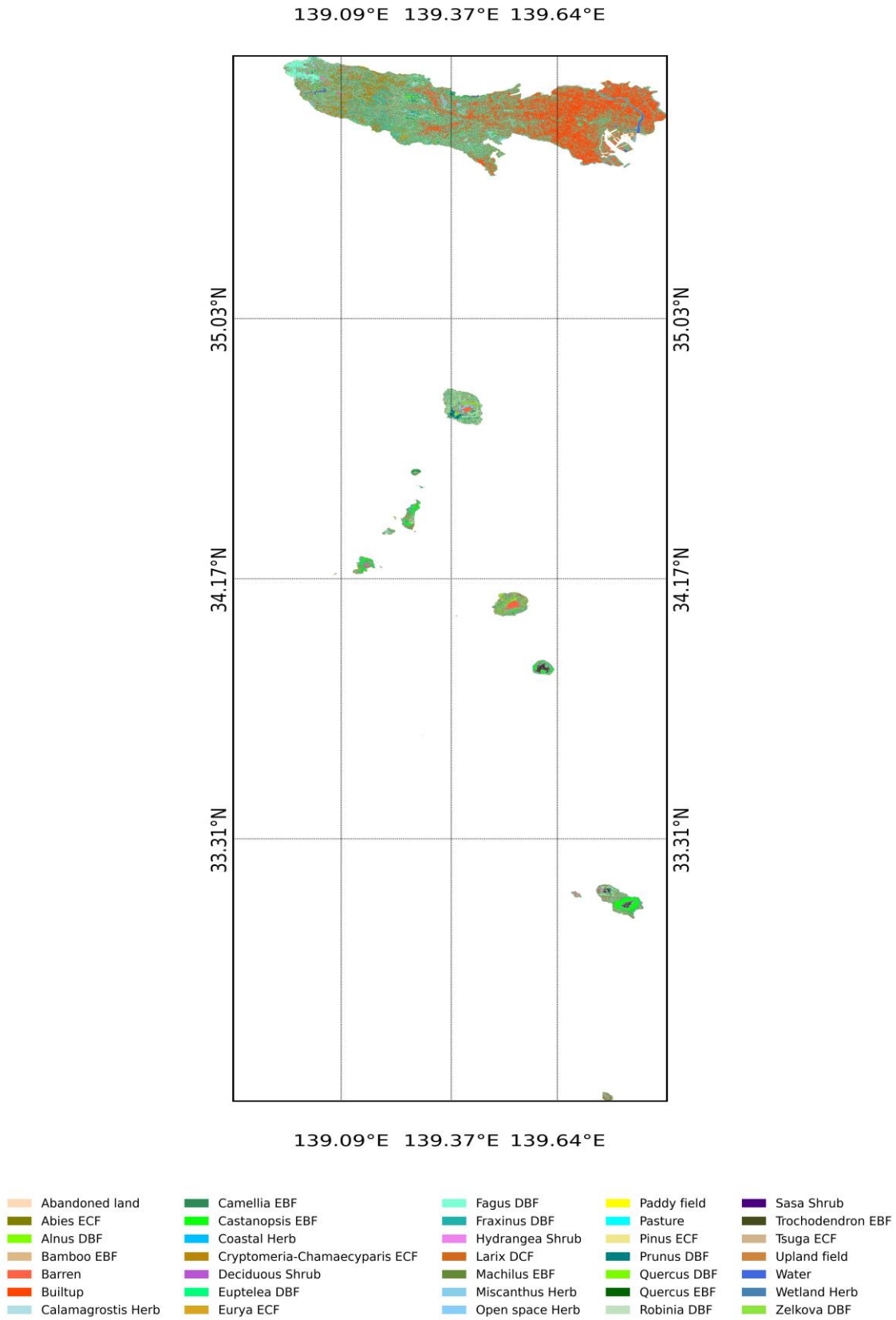
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.41. Tokushima prefecture GPE map



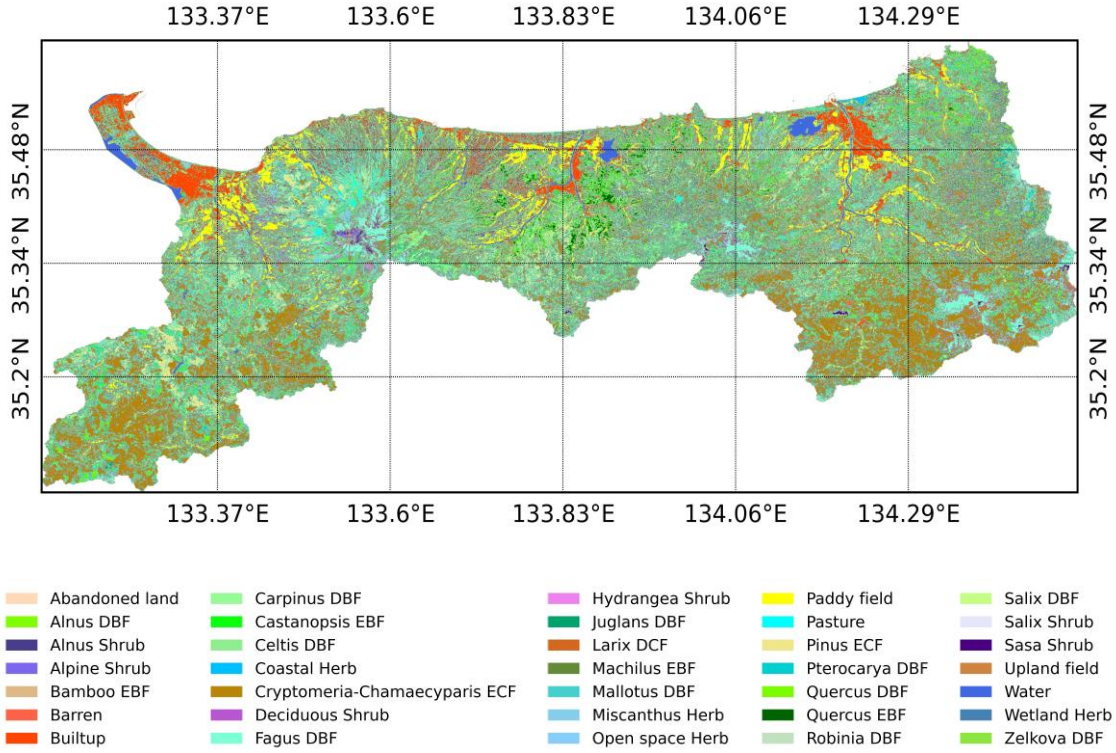
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.42. Tokyo prefecture GPE map



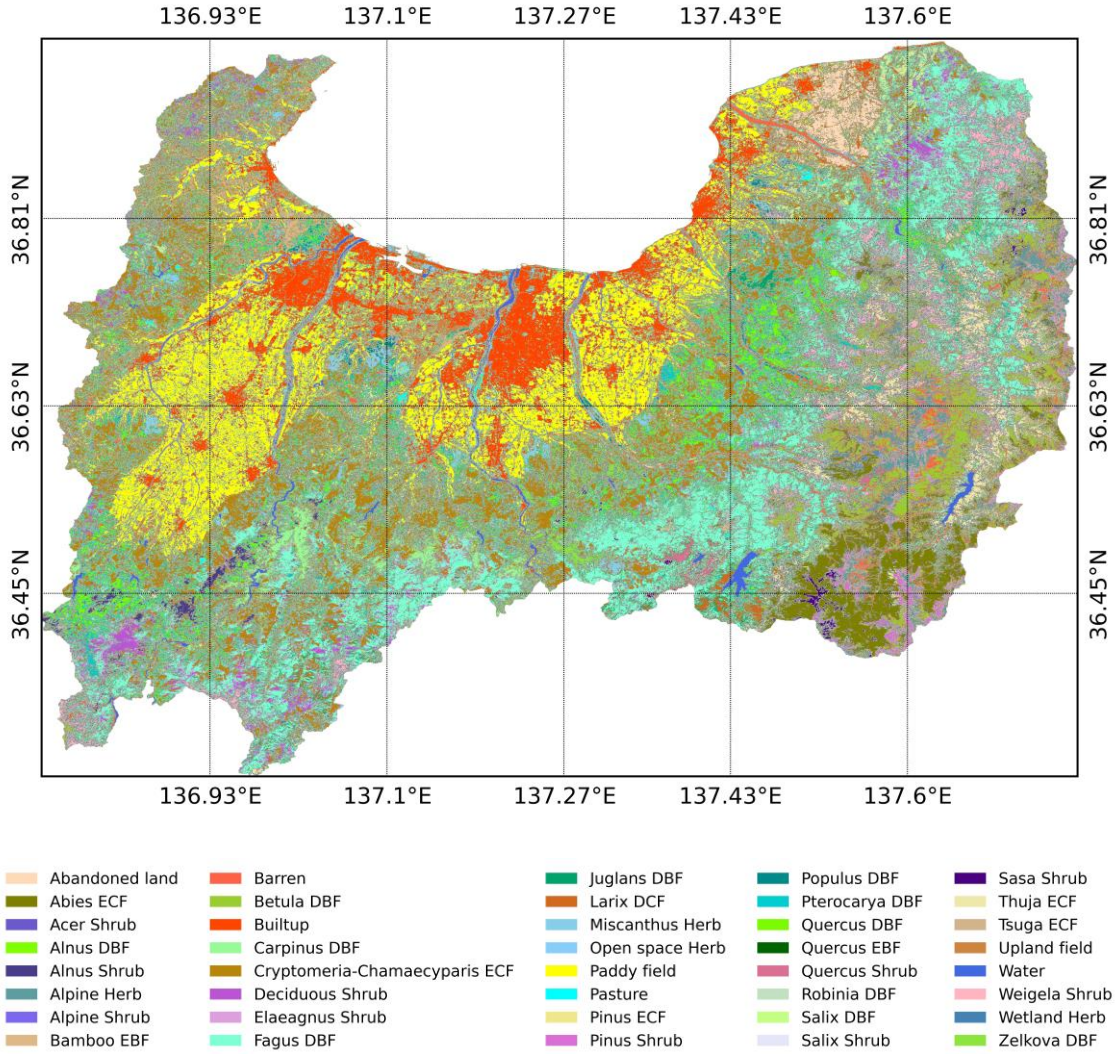
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.43. Tottori prefecture GPE map



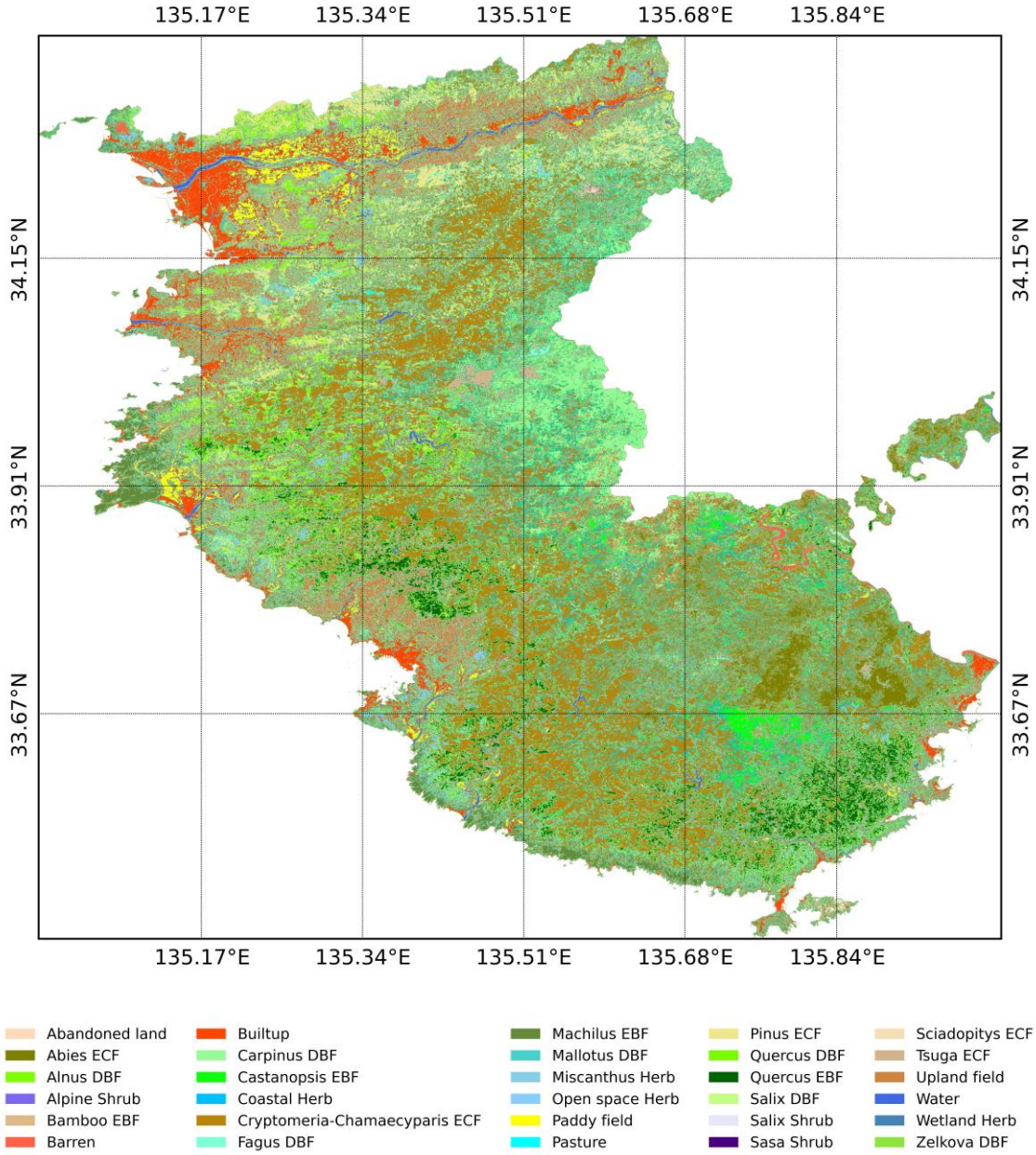
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.44. Toyama prefecture GPE map



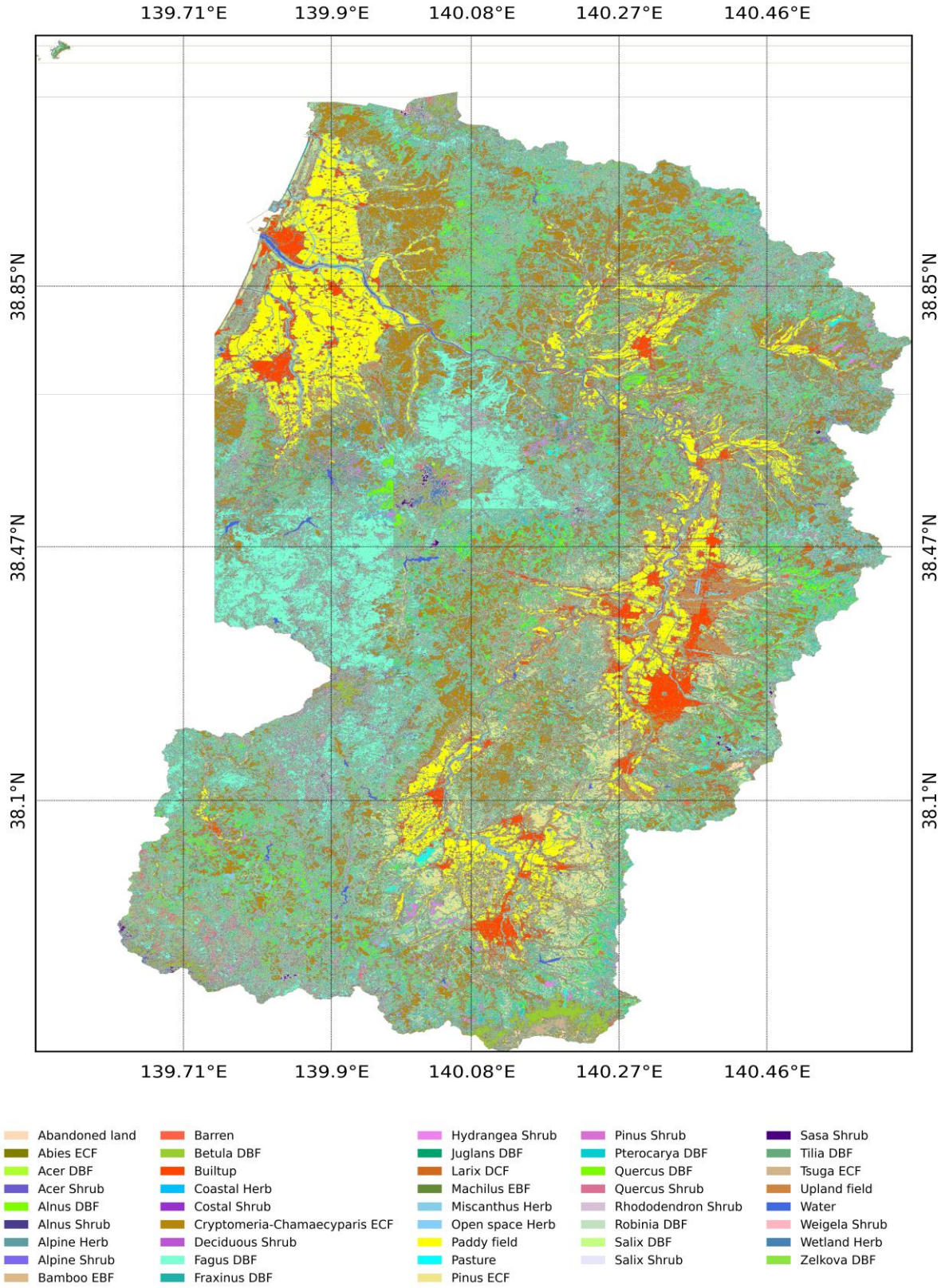
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.45. Wakayama prefecture GPE map



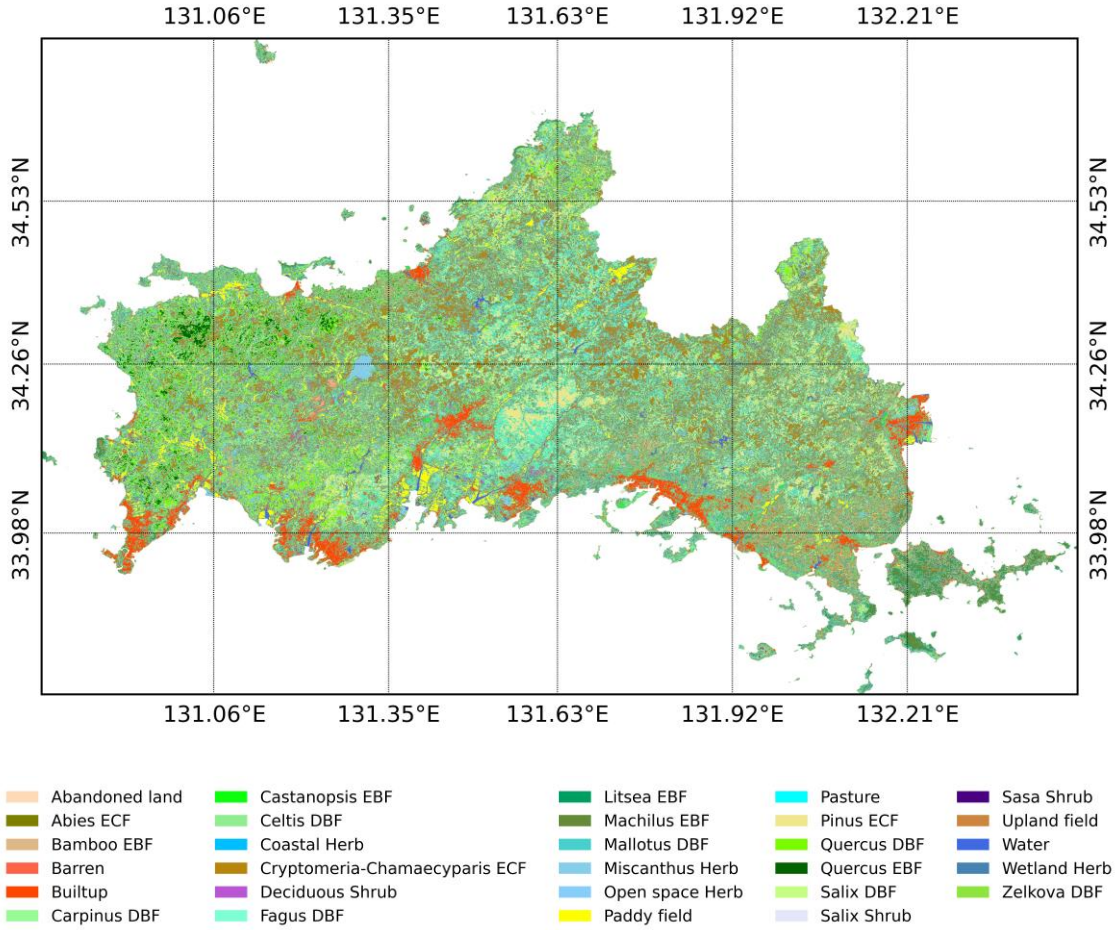
Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.46. Yamagata prefecture GPE map



Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.47. Yamaguchi prefecture GPE map



Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 January 2022 doi:10.20944/preprints202201.0123.v1

3.48. Yamanashi prefecture GPE map