

Reference region (MRR): BETIC SYSTEMS

Reference Landscape (MRL): SUBBETICA CORDOBESA – BETIC SYSTEMS MRL

FILE NAME	DATA	SCALE	SOURCE
MRL17_BeticSystems	Delimitation of Reference Landscape	Reference Landscape	
MRL17_Abandonment	Risk of agricultural abandonment by 2030 the main land systems	Reference Landscape	Perpiña et al. 2018, 2020, 2021
MRL17_AsselenVerburg_LUS	Land systems distribution according to the classification of van Asselen and Verburg (2012)	Reference Landscape	Global Fire Atlas
MRL17_BurnedAreas	Burned Areas between 2003 and 2018	Reference Landscape	Global Fire Atlas
MRL17_CombinedForestPressure	Combined forest pressure	Reference Landscape	Kleeschulte et al. 2014
MRL17_FloodHazard	Susceptibility to floods for several return periods (average time or an estimated average time between events) - 10, 20, 50, 100 & 200 years	Reference Landscape	JCR
MRL17_ForestDist	Forest Disturbance Severity between 1986 & 2016	Reference Landscape	Senf & Seidl, 2021
MRL17_LSprojections_G	Land system projections for 2050 under a growth scenario	Reference Landscape	Malek et al. 2018; Malek & Verburg 2017
MRL17_LSprojections_S	Land system projections for 2050 under a sustainability scenario	Reference Landscape	Malek et al. 2018; Malek & Verburg 2018
MRL17_Levers_LS	Spatial distribution of the main land systems according to the classification of Levers et al. (2018)	Reference Landscape	Levers et al. 2018
MRL17_Levers_LS_Trajectories	Archetypal change trajectories in land systems between 1990 and 2006	Reference Landscape	Levers et al. 2018
MRL17_MalekVerburg_LUS	Land systems distribution based on the classification of Malek and Verburg (2017)	Reference Landscape	Malek and Verburg 2017
MRL17_LS_WinDE	Land susceptibility to Wind Erosion	Reference Landscape	Borelli et al. 2014,2015,2016, 2017
MRL17_RainEro2050	Rainfall erosivity in 2050 (MJ.mm)/(ha.h.year)	Reference Landscape	Ballabio et al. 2017; Bezak et al 2020; Panagos et al. 2015, 2016, 2017
MRL17_RainEroDifference	Rainfall erosivity in [2050-present] (MJ.mm)/(ha.h.year)	Reference Landscape	Ballabio et al. 2017; Bezak et al 2020; Panagos et al. 2015, 2016, 2017
MRL17_RainEroPresent	Rainfall erosivity at the present (MJ.mm)/(ha.h.year)	Reference Landscape	Ballabio et al. 2017; Bezak et al 2020; Panagos et al. 2015, 2016, 2017
MRL17_Rega_CMS	Crop management systems	Reference Landscape	Rega et al. 2020
MRL17_SLP_WinDE	Soil Loss Potencial due to Wind Erosion (Mg/ha.year)	Reference Landscape	Borelli et al. 2014,2015,2016a, b
MRL17_Slope	Slope	Reference Landscape	
MRL17_SoilLoss	Soil Loss (ton/ha.year). RUSLE formula: $E=R.K.C.LS.P$ E: annual average soil loss ($t\ ha^{-1}\ yr^{-1}$), R: rainfall erosivity factor ($MJ\ mm\ ha^{-1}\ h^{-1}\ yr^{-1}$), K: soil erodibility factor ($t\ ha\ h\ ha^{-1}\ MJ^{-1}\ mm^{-1}$), C: cover-management factor (dimensionless), LS: slope length and slope steepness factor (dimensionless), and P: support practices factor (dimensionless).	Reference Landscape	Panagos et al. 2015
MRL17_SoilLoss_RCP45	Soil Loss in 2050 under scenario RCP4.5 (ton/ha.year)	Reference Landscape	Panagos et al. 2021



MRL17_SoilLoss_RCP85	Soil Loss in 2050 under scenario RCP8.5 (ton/ha.year)	Reference Landscape	Panagos et al. 2022
MRL17_WindEFS	Wind-erodible Fraction of the Soil (%)	Reference Landscape	Borelli et al. 2014,2015,2016, 2019
MRR22_AlfaMult	Spatial distribution of alpha-multifunctionality (ecosystem services supplied within each municipality) .	Reference Region	Hölting et al. 2019
MRR22_BetaMult	Spatial distribution of beta-multifunctionality(the unique contribution of each municipality to the regional ecosystem service diversity)	Reference Region	Hölting et al. 2019
MRR22_CLC18	Spatial distribution of the land cover classes in 2018	Reference Region	CORINE Land Cover, level 2
MRR22_CMS	Crop management systems	Reference Region	Rega et al. 2020
MRR22_HANPP_1990	Spatial distribution of the Human Appropriation of Net Primary Productivity (HANPP) in 1990. (Bar chart: Y axis – frequency of pixels; X axis – HANPP classes)	Reference Region	Plutzer et al. 2016
MRR22_HANPP_2000	Spatial distribution of the Human Appropriation of Net Primary Productivity (HANPP) in 2000. (Bar chart: Y axis – frequency of pixels; X axis – HANPP classes)	Reference Region	Plutzer et al. 2016
MRR22_HANPP_2006	Spatial distribution of the Human Appropriation of Net Primary Productivity (HANPP) in 2006. (Bar chart: Y axis – frequency of pixels; X axis – HANPP classes)	Reference Region	Plutzer et al. 2016
MRR22_HANPP_graph	Human Appropriation of Net Primary Productivity temporal variation (1990-2000-2006). Y axis – frequency of pixels; X axis – percentage classes	Reference Region	Plutzer et al. 2016
MRR22_LS1	Spatial distribution of the main land systems according to the classification of van Asselen and Verburg (2012)	Reference Region	van Asselen and Verburg 2012
MRR22_LS2	Spatial distribution of the main land systems according to the classification of Levers et al. (2018)	Reference Region	Levers et al. 2018
MRR22_LS3	Spatial distribution of the main land systems according to the classification of Malek and Verburg (2017)	Reference Region	Malek and Verburg 2017
MRR22_LS4	Archetypal change trajectories in land systems between 1990 and 2006	Reference Region	Levers et al. 2018
MRR22_TCD2012	Distribution of the tree cover (%) in 2012 (Bar chart: Y axis – frequency of pixels; X axis – percentage classes)	Reference Region	COPERNICUS Land Monitoring Service – High Resolution Layers
MRR22_TCD2015	Distribution of the tree cover (%) in 2015 (Bar chart: Y axis – frequency of pixels; X axis – percentage classes)	Reference Region	COPERNICUS Land Monitoring Service – High Resolution Layers
MRR22_TCD2018	Distribution of the tree cover (%) in 2018 (Bar chart: Y axis – frequency of pixels; X axis – percentage classes)	Reference Region	COPERNICUS Land Monitoring Service – High Resolution Layers
MRR22_TCD_graph	Temporal Variation of tree cover density (2012-2015-2018). Y axis – frequency of pixels; X axis – percentage classes	Reference Region	COPERNICUS Land Monitoring Service – High Resolution Layers
MRR22_Treesp	Dominant tree species in 2018	Reference Region	Brus et al. 2012
MRR22_WP_graph	Wood production temporal variation (2000-2010). Y axis – frequency of pixels; X axis – wood production classes	Reference Region	Verkerk et al. 2015
MRR22_WP2000	Spatial distribution of wood production (m3/ha) in 2000. (Bar chart: Y axis – frequency of pixels; X axis – wood production classes)	Reference Region	Verkerk et al. 2015
MRR22_WP2005	Spatial distribution of wood production (m3/ha) in 2005. (Bar chart: Y axis – frequency of pixels; X axis – wood production classes)	Reference Region	Verkerk et al. 2015
MRR22_WP2010	Spatial distribution of wood production (m3/ha) in 2010. (Bar chart: Y axis – frequency of pixels; X axis – wood production classes)	Reference Region	Verkerk et al. 2015

References

- Bezák, N., Ballabio, C., Mikoš, M., Petan, S., Borrelli, P., Panagos, P. (2020). Reconstruction of past rainfall erosivity and trend detection based on the REDES database and reanalysis rainfall. *Journal of Hydrology* 590: 125372, doi: 10.1016/j.jhydrol.2020.125372
- Borrelli, P., Ballabio, C., Panagos, P., Montanarella, L. (2014). Wind erosion susceptibility of European soils. *Geoderma* 232–234: 471–478, doi: 10.1016/j.geoderma.2014.06.008
- Borrelli, P., Lugato, E., Montanarella, L., Panagos, P. (2017). A new assessment of soil loss due to wind erosion in European agricultural soils using a quantitative spatially distributed modelling approach. *Land Degradation and Development* 28: 335–344, doi: 10.1002/ldr.2588
- Borrelli, P., Panagos, P., Ballabio, C., Lugato, E., Weynants, M., Montanarella, L. (2016). Towards a pan-European assessment of land susceptibility to wind erosion. *Land Degradation and Development* 27: 1093–1105, doi: 10.1002/ldr.2318
- Borrelli, P., Panagos, P., Montanarella, L. (2015). New insights into the geography and modelling of wind erosion in the European agricultural land. Application of a spatially explicit indicator of land susceptibility to wind erosion. *Sustainability* 7: 8823–8836. doi: 10.3390/su7078823
- Brus, D.J., Hengeveld, G.M., Walvoort, D.J.J., Goedhart, P.W., Heidema, A.H., Nabuurs, G.J., Gunia, K., 2012. Statistical mapping of tree species over Europe. *European Journal of Forest Research* 131: 145–157
- Brus, D.J., Hengeveld, G.M., Walvoort, D.J.J., Goedhart, P.W., Heidema, A.H., Nabuurs, G.J., Gunia, K., 2012. Statistical mapping of tree species over Europe. *European Journal of Forest Research* 131: 145–157
- d’Andrimont, R., Verhegghen, A., Lemoine, G., Kempeneers, P., Meroni, M., van der Velde, M. (2021). From parcel to continental scale – A first European crop type map based on Sentinel-1 and LUCAS Copernicus in-situ observations. *Remote Sensing of Environment*, 266:112708. <https://doi.org/10.1016/j.rse.2021.112708>
- Hölting, L., Jacobs, S., Felipe-Lucia, M.R., Maes, J., Norström, A.V., Plieninger, T., Cord, A.F., 2019. Measuring ecosystem multifunctionality across scales. *Environmental Research Letters* 14(12): 124083
- Hölting, L., Jacobs, S., Felipe-Lucia, M.R., Maes, J., Norström, A.V., Plieninger, T., Cord, A.F., 2019. Measuring ecosystem multifunctionality across scales. *Environmental Research Letters* 14(12): 124083
- Kleeschulte, S., Philipsen, C., Becerra-Jurado, G. (2014). Land use and land management related pressures on agricultural and forest ecosystems in Europe - Task 1.8.4.3 Ecosystem pressures. European Environment Agency.
- Levers, C., Müller, D., Erb, K., Haberl, H., Jepsen, M.R., Metzge, M.J., Meyfroidt, P., Plieninger, T., Plutzer, C., Stürck, J., 2018. Archetypical patterns and trajectories of land systems in Europe. *Regional Environmental Change* 18: 715–732
- Malek, Ž., Verburg, P.H., 2017. Mediterranean land systems: Representing diversity and intensity of complex land systems in a dynamic region. *Landscape and Urban Planning* 165:102–116.

- Malek, Ž., Verburg, P.H., Geijzendorffer, I.R., Bondeau, A., Cramer, W. (2018). Global change effects on land management in the Mediterranean region. *Global Environmental Change*, 50:238–254. <https://doi.org/10.1016/j.gloenvcha.2018.04.007>
- Panagos, P., Ballabio, C., Borrelli, P., Meusburger, K., Klik, A., Rousseva, S., Tadić, M.P., Michaelides, S., Petan, S., Hrabalíková, M., Beguería, S., Alewell, C. (2015a). Rainfall erosivity in Europe. *Science of the Total Environment*, 511, 801-814.
- Panagos, P., Borrelli, P., Meusburger, K., Yu, B., Klik, A., Lim, K. J., Yang, J. E., Ni, J., Miao, C., Chattopadhyay, N., Sadeghi, S. H., Hazbavi, Z., Zabihi, M., Larionov, G. A., Krasnov, S. F., Gorobets, A. V., Levi, Y., Erpul, G., Birkel, C., Hoyos, N., Naipal, V., Oliveira, P. T. S., Bonilla, C. A., Meddi, M., Nel, W., Dashti, H. A., Boni, M., Diodato, N., Van Oost, K., Nearing, M., Ballabio, C. (2017). Global rainfall erosivity assessment based on high-temporal resolution rainfall records. *Scientific Reports*, 7:4175. DOI:10.1038/s41598-017-04282-8
- Panagos, P., Borrelli, P., Spinoni, J., Ballabio, C., Meusburger, K., Beguería, S., Klik, A., Michaelides, S., Petan, S., Hrabalíková, M., Olsen, P., Aalto, J., Lakatos, M., Rymaszewicz, A., Dumitrescu, A., Tadić, M.P., Diodato, N., Kostalova, J., Rousseva, S., Banasik, K., Alewell, C. (2016). Monthly rainfall erosivity: conversion factors for different time resolutions and regional assessments. *Water*, 8(4), 119.
- Perpiña-Castillo C., Kavalov B., Diogo V., Jacobs-Crisioni C., Batista e Silva F., Lavalle C. (2018). Agricultural land abandonment in the UE within 2015-2030. JRC113718. European Commission.
- Perpiña-Castillo, C., Aliaga, E. C., Lavalle, C., Llarío, J. C. M. (2020). An Assessment and Spatial Modelling of Agricultural Land Abandonment in Spain (2015–2030). *Sustainability*, 12:560. doi:10.3390/su12020560
- Perpiña-Castillo, C., Jacobs-Crisioni, C., Diogo, V., Lavalle, C. (2021). Modelling agricultural land abandonment in a fine spatial resolution multi-level land-use model: An application for the EU. *Environmental Modelling and Software* 136: 104946. <https://doi.org/10.1016/j.envsoft.2020.104946>
- Plutzer, C., Kroisleitner, C., Haberl, H., Fetzel, T., Bulgheroni, C., Beringer, T., Hostert, P., Kastner, T., Kuemmerle, T., Lauk, C., Levers, C., Lindner, M., Moser, D., Müller, D., Niedertscheider, M., Paracchini, M.L., Schaphoff, S., Verburg, P.H., Verkerk, P.J., Erb, K.-H., 2016. Changes in the spatial patterns of human appropriation of net primary production (HANPP) in Europe 1990-2006. *Regional Environmental Change* 16: 1225-1238.
- Rega, C., Short, C., Pérez-Soba, M., Paracchini, M.L., 2020. A classification of European agricultural land using an energy-based intensity indicator and detailed crop description. *Landscape and Urban Planning* 198: 103793.
- Senf, C., Seidl, R. (2021). Mapping the forest disturbance regimes of Europe. *Nature Sustainability*, 4(1), 63-70.
- Van Asselen, S., Verburg, P.H., 2012. A Land System representation for global assessments and land-use modeling. *Global Change Biology* 18: 3125-3148.
- Verkerk, P.J., Levers, C., Kuemmerle, T., Lindner, M., Valbuena, R., Verburg, P.H., Zudin, S., 2015. Mapping wood production in European forests. *Forest Ecology and Management* 357: 228-238.