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《黑土地保护》专题快报

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《中国工程院战略咨询项目信息参考》是中国工程科技知识中心提供的一项信息推送服务，该服务组织专业团队，基于中国工程科技知识中心地理资源与生态专业分中心在工程科技领域积累的数据资源，面向战略咨询研究项目需求提供信息的搜集、整理、加工、推送服务。

该信息参考面向院士专家开放订阅，每两周一期，欢迎订阅。



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【动态信息】

1. 标题：日本生态农业：火煨稻壳后自制“人造黑土”，难道不怕污染环境？

【科普是启示录】根据中国人刻入骨子里的种地基因来看，大家都耳熟能详的一个常识：那就是黄土不如黑土，只要是庄稼人，就没有不梦想自己脚下的土地，是肥沃且高产的。而黑土之所以肥沃的原因，就是因为其中富含大量的矿物质，这些矿物质经过土壤中的微生物分解之后，会为植物提供生长所必需的养分。其中“一两土二两油”的比喻，足以见得土壤的肥沃。

链接：

<https://baijiahao.baidu.com/s?id=1759325234233629196&wfr=spider&for=pc>

2. 标题：北大荒二道河农场有限公司：秸秆变废为宝 保护黑土拓宽水稻育苗基质

【新华网】北大荒二道河农场有限公司利用东北农业大学生物菌剂研发中心自主研发的“低温秸秆腐熟剂”，在秋季和冬季利用过剩农作物秸秆进行发酵腐熟，利用微生物和秸秆腐熟制备水稻育苗基质，优化水稻育苗土的配制比例，为公司秸秆综合利用、黑土地保护和农业可持续发展提供技术保障

链接：

http://www.hlj.xinhuanet.com/nycj/2023-03/18/c_1310703693.htm

3. 标题：亚布力论坛扎根黑土 23 年 政企缔结累累硕果

【中国新闻网】亚布力中国企业家论坛第 23 届年会开幕翌日，户籍人口不足 5 万人的黑龙江偏远小镇亚布力传出喜讯，借助亚布力论坛这一优质平台，黑龙江省共计签约项目 131 个，总签约额 1511.56 亿元。亚布力中国企业家论坛扎根黑龙江 23 年，汇聚业界精英、企业大咖，交流思想、碰撞智慧、转化成果，为黑龙江发展作出了积极贡献。

链接：

<https://baijiahao.baidu.com/s?id=1760681697522040040&wfr=spider>

[&for=pc](#)

4. 标题：建立“国家黑土地保护及乡村高端产业发展先导区”

【农民日报】全国人大代表、飞鹤乳业董事长冷友斌在接受记者采访时说，建议立足黑龙江优质黑土核心区域，建立国家级黑土地保护及乡村高端产业发展先导区，集聚政策要素，放大资源优势，深化实施四大行动，引领乡村振兴高质量发展。

链接：

<https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C45iO2vZ0j>

[Wu7ShS_sKvBZ6Q62aLvZ2-](#)

[JHCJTbFwOACPXovpF2RLkLF4pIaurxwU-](#)

[JuEgUm0g1rVSkJ0vcbxsBwR&uniplatform=NZKPT](#)

【文献速递】

1. 2000—2020年东北黑土区耕地单产时空格局演化特征

文献源：中国农业大学学报，2023

作者：李全峰，黄宇，杜国明，瞿诗进，李玉清

摘要：为揭示东北黑土区耕地单产时空演变规律，本研究以县域为评价单元，基于时空演变与区域差异的研究视角，采用NPP换算耕地单产的方法，探究2000—2020年东北黑土区全域及其县域单产时空格局演化特征。研究表明：1)2000—2020年东北黑土区全域耕地单产在时序上呈波动上升趋势，共增加了0.79 t/hm²；低单产县、中单产县、高单产县数量减少，较高单产县数量增加，耕地单产内部差异基本不变。2)东北黑土区不同县域耕地单产在空间上非均衡状态明显。其中低单产县分布于黑土区西南部，中单产县集聚于黑土区西部，较高单产县分布于黑土区西北、东北与南部，高单产县分布于黑土区东南部。全域单产变化幅度沿“肇东—虎林”连线递减分布。3)结合区域单产与地形起伏度分异可知，东北黑

土区单产受地形起伏度影响较大,且起伏度高值区与县域单产高值区具有一致性。研究框架及结果对县域单产提升等具有积极意义。

2. 东北黑土区不同开垦年限坡耕地坡面土壤磁化率特征研究

文献源: 南京林业大学学报(自然科学版), 2023

作者: 于悦, 赵丽君, 张威, 张科利, 刘亮

摘要: 【目的】东北黑土区是我国重要的粮食基地, 由于长期的不合理利用, 黑土资源遭受严重的水力侵蚀。阐明土壤磁化率的时空分异特征, 探讨磁化率指标评价土壤侵蚀的可行性。【方法】磁化率(MS)技术是一种快速、可靠、经济的土壤再分配评价方法。本文在黑龙江省鹤山农场选取 3 个开垦年限的典型黑土坡面, 顺坡等间距布设坡面采样点, 分别选取百米范围内的林地作为参考样点, 采集原状土壤剖面样品和非原装土壤表层样品, 剖面样品的采样深度为 60~100 cm, 表层样品的采样深度为 20 cm, 测定样品磁化率等理化指标, 分析不同开垦年限土壤磁化率的时空异质性, 探讨黑土区坡耕地土壤侵蚀特征。【结果】不同土壤剖面磁化率均随土层深度的增加而降低, 至母质层趋于平稳, 符合弱磁性母质发育的温带土壤磁性特征; 坡上和坡中耕层的低频磁化率平均值小于参考点, 分别为 $24.1 \times 10^{-8} \text{ m}^3/\text{kg}$ 和 $24.8 \times 10^{-8} \text{ m}^3/\text{kg}$, 坡下耕层低频磁化率平均值大于参考点, 为 $39.7 \times 10^{-8} \text{ m}^3/\text{kg}$, 符合坡面土壤侵蚀的一般规律; 开垦 110 a 的农地低频磁化率变化范围最大, 为 $1.7 \times 10^{-8} \sim 88.7 \times 10^{-8} \text{ m}^3/\text{kg}$, 分别约为开垦年限 60 a 和 30 a 的 1.4 和 1.9 倍。【结论】黑土区坡耕地表层土壤磁化率均具有坡面异质性, 坡上和坡中为侵蚀区, 坡下为沉积区, 且开垦时间越长, 耕地坡面土壤再分配程度越高, 即开垦 110 a 坡面土壤侵蚀最为强烈。本研究验证了土壤磁性表征土壤侵蚀规律的可行性, 揭示了不同开垦年限黑土坡耕地土壤侵蚀特点, 研究结果能够为东北黑土区水土流失预报与防治提供理论依据, 有利于区域农业可持续发展和生态环境保护。

3. 大兴安岭西麓黑土旱作农田不同地力水平土壤养分分析

文献源: 黑龙江农业科学, 2023

作者: 唐广彬, 骆瓔珞, 黄修梅, 李濛池, 惠霖, 王籽懿, 卢旭东

摘要：为保护和培育黑土，通过田间随机取样和室内养分分析，调查大兴安岭西麓谢尔塔拉农牧场不同地力等级土壤肥力状况及养分差异。结果表明，有机质、有效磷和缓效钾含量与地力等级相关性较好，随着地力等级的升高，含量呈升高趋势；其中有机质含量变化最大，一等地平均含量为 $62.93 \text{ g}\cdot\text{kg}^{-1}$ ，五等地为 $36.71 \text{ g}\cdot\text{kg}^{-1}$ ，一等地是五等地的 1.71 倍，一至四等地有机质含量均属于国家土壤普查土壤养分分级标准很丰富的水平，五等地属于丰富的水平；有效磷和缓效钾一等地分别是五等地的 1.36 倍和 1.31 倍。pH、全氮、碱解氮、速效钾也随着地力等级的升高呈升高趋势，全磷和全钾未呈现规律性变化，不同等级地力间均未形成显著性差异。不同地力等级平均有效铜、有效硼、有效锌含量适中，有效锰、有效钼含量丰富，有效铁含量极丰富。

4. Assessment of gully erosion susceptibility using different DEM-derived topographic factors in the black soil region of Northeast China

文献源：International Soil and Water Conservation Research, 2023

作者：Donghao Huang, Lin Su, Lili Zhou, Yulu Tian, Haoming Fan

摘要：As a primary sediment source, gully erosion leads to severe land degradation and poses a threat to food and ecological security. Therefore, identification of susceptible areas is critical to the prevention and control of gully erosion. This study aimed to identify areas prone to gully erosion using four machine learning methods with derived topographic attributes. Eight topographic attributes (elevation, slope aspect, slope degree, catchment area, plan curvature, profile curvature, stream power index, and topographic wetness index) were derived as feature variables controlling gully occurrence from digital elevation models with four different pixel sizes (5.0 m, 12.5 m, 20.0 m, and 30.0 m). A gully inventory map of a small agricultural catchment in Heilongjiang, China, was prepared through a combination of field surveys and satellite imagery. Each topographic attribute dataset was randomly divided into two portions of 70% and 30% for calibrating and validating four machine learning methods, namely random forest (RF), support vector machines (SVM), artificial neural network (ANN), and generalized linear models (GLM). Accuracy (ACC), area under the receiver operating characteristic curve (AUC), root mean square error (RMSE), and mean

absolute error (MAE) were calculated to assess the performance of the four machine learning methods in predicting spatial distribution of gully erosion susceptibility (GES). The results suggested that the selected topographic attributes were capable of predicting GES in the study catchment area. A pixel size of 20.0 m was optimal for all four machine learning methods. The RF method described the spatial relationship between the feature variables and gully occurrence with the greatest accuracy, as it returned the highest values of ACC (0.917) and AUC (0.905) at a 20.0 m resolution. The RF was also the least sensitive to resolutions, followed by SVM (ACC = 0.781–0.891, AUC = 0.724–0.861) and ANN (ACC = 0.744–0.808, AUC = 0.649–0.847). GLM performed poorly in this study (ACC = 0.693–0.757, AUC = 0.608–0.703). Based on the spatial distribution of GES determined using the optimal method (RF + pixel size of 20.0 m), 16% of the study area has very high level susceptibility classes, whereas areas with high, moderate, and low levels of susceptibility make up approximately 24%, 30%, and 31% of the study area, respectively. Our results demonstrate that GES assessment with machine learning methods can successfully identify areas prone to gully erosion, providing reference information for future soil conservation plans and land management. In addition, pixel size (resolution) is the key consideration when preparing suitable datasets of feature variables for GES assessment.

5. Gully erosion susceptibility assessment based on machine learning-A case study of watersheds in Tuquan County in the black soil region of Northeast China

文献源: CATENA, 2023

作者: Congtan Liu, Haoming Fan, Yanyan Jiang, Renming Ma, Shuang Song

摘要: Owing to its unique topographic and climatic conditions, agricultural production, and anthropogenic grazing, severe gully erosion has developed in the watersheds of Tuquan County located in the black soil region of Northeast China. Using three machine learning models to assess gully erosion susceptibility in this region, the main purpose of this study was to determine the important factors affecting the occurrence of gully erosion from 25 geo-environmental factors and select the model with the best prediction

performance. Field data collection was conducted for 823 gullies. 12,496 pixels corresponding to 823 gullies and 12,496 pixels without gully erosion were randomly selected to form the model calculation database. According to the principle of multiple screening, this study selected 25 geo-environmental factors affecting the occurrence of gully erosion. Two factors, coarse sand content and fine sand content, were excluded by multi-collinearity analysis and using random forest (RF), convolution neural network (CNN), and transformer models, combining the 10-fold cross-validation and related validation metrics to assess the susceptibility of gully erosion in Tuquan County's small watersheds. The results show that the convergence index (CI), topographical wetness index (TWI), terrain ruggedness index (TRI), and distance from the river based on the RF model are important factors affecting the occurrence of gully erosion. The transformer model (mean AUC of training = 95.338 %, mean AUC of validation = 95.342 %) was superior to the RF (mean AUC of training = 99.997 %, mean AUC of validation = 92.518 %) and CNN (mean AUC of training = 86.995 %, mean AUC of validation = 84.647 %) models in predicting performance. To ensure that the management and decision-making departments take reasonable and effective measures to prevent gully erosion in the study area, the gully erosion susceptibility maps produced using the three machine learning models were beneficial.

【专利】

1. 黑土地保护措施匹配方法、装置及存储介质

专利号：CN115630785A

摘要：本发明涉及土地保护技术领域，是关于一种黑土地保护措施匹配方法、装置及存储介质，方法包括：获取样本地点数据集；利用样本地点数据集和随机森林模型进行训练，得到黑土地保护措施匹配模型；获取东北黑土地地区的土壤属性、气候属性和地貌属性的专题图，并进行网格化处理，以得到东北黑土地地区各个地点的土壤属性数据、气候属性数据和地貌属性数据；根据东北黑土地地区各个地点

的土壤属性数据、气候属性数据和地貌属性数据,利用黑土地保护措施匹配模型,确定各个地点对应的保护措施。通过该技术方案,保证黑土地根据其自身的土壤属性能够得到因地制宜的保护。

链接:

[https://pss-system.cponline.cnipa.gov.cn/download/literature/2023-](https://pss-system.cponline.cnipa.gov.cn/download/literature/2023-03-19/%E4%B8%8B%E8%BD%BD_fb4e5f3f051846d18c40857275819e54.zip)

[03-](https://pss-system.cponline.cnipa.gov.cn/download/literature/2023-03-19/%E4%B8%8B%E8%BD%BD_fb4e5f3f051846d18c40857275819e54.zip)

[19/%E4%B8%8B%E8%BD%BD_fb4e5f3f051846d18c40857275819](https://pss-system.cponline.cnipa.gov.cn/download/literature/2023-03-19/%E4%B8%8B%E8%BD%BD_fb4e5f3f051846d18c40857275819e54.zip)

[e54.zip](https://pss-system.cponline.cnipa.gov.cn/download/literature/2023-03-19/%E4%B8%8B%E8%BD%BD_fb4e5f3f051846d18c40857275819e54.zip)

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