

## 《智慧农业发展战略研究》专题快报

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中国工程科技知识中心农业分中心

中国农业科学院农业信息研究所

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### 【动态资讯】

#### 1. 科学保土养地指导送上门

【农民日报】近日，在四川省阆中市文成镇云台村罐山香甜李、无花果园，白沙坝村的火龙果基地、大桥村蜜柚园、梁山村的草莓大棚等家庭农场的田间地头，由文成镇和阆中邮政农资配送中心组成的技术人员，为村民们开展免费测土配方施肥工作，为耕地“把脉问诊”。

链接:

<http://agri.ckcest.cn/file1/M00/0F/F2/Csgk0GIArHGACtNaAFyzgANTfv8322.pdf>

#### 2. 入世二十年中国畜产品贸易动态与思考

【农民日报】为了充分了解入世以来中国畜产品贸易情况，服务于畜产品国际交流合作；协助中国农牧企业更好地参与市场竞争和国际贸易；推进高质量引进来和高水平走出去，以实现中国农牧业的高质量发展，本文从中国对外贸易、农产品贸易和畜牧业发展的角度，以国家统计局、中国海关和农业农村部农业贸易促进中心的统计数据为依据，通过梳理中国畜产品贸易动态，探讨乡村振兴战略背景下、实现中国农牧业高质量发展可能选择的路径。

链接:

<http://agri.ckcest.cn/file1/M00/03/20/Csgk0YZXFCAJLqnAApgXICV8s4994.pdf>

#### 3. 循生态之道 得鱼水共欢

【农民日报】习近平总书记强调，人与自然是生命共同体，人类必须尊重自然、顺应自然、保护自然。人类只有遵循自然规律，才能有效防止在开发利用自然上走弯路。在新时代，坚持“生态优先，绿色发展”，必须要正确处理好鱼水关系，加快恢复江河湖海的

鱼类资源。文明源于江河，水运连着国运。千百年来，人在岸上走，鱼在水中游，鱼水共欢、人水和谐，构筑起一幅幅人类与自然共生的美好画面。2021年12月10日，农业农村部、安徽省人民政府联合举办2021年长江水生生物科学增殖放流活动，在芜湖市江段，放流中华鲟、胭脂鱼等珍贵濒危鱼类和青鱼、长吻鮠等长江重要鱼类10万余尾。主办方表示，要深入贯彻落实习近平生态文明思想，保护好中华民族母亲河；要利用好长江十年禁渔重要窗口期，以恢复生物多样性为目标，多措并举强化长江水生生物资源保护。

**链接:**

[http://agri.ckcest.cn/file1/M00/0F/F2/Csgk0GIAme-AbbPbADE859-wU\\_E262.pdf](http://agri.ckcest.cn/file1/M00/0F/F2/Csgk0GIAme-AbbPbADE859-wU_E262.pdf)

#### **4. 生物所“未来农业”青年科技论坛 聚焦智能设计育种**

**【中国农业科学院】**新一期“未来农业”青年科技论坛开讲，论坛聚焦生物技术前沿科技——智能设计育种，邀请中国农业大学农学院、国家玉米改良中心王向峰教授以“从生物学角度理解一个成功植物育种家领悟的十件事”为题作专题报告，并与参会青年科研人员共同探讨前沿技术的突破性进展，交流前沿技术支撑基础研究，开拓科学问题解析新思路。随着育种新技术的发展，育种工作已进入以技术交叉融合多元化、数据驱动决策智能化、育种体系工程化的“育种4.0”或“5G”时代。王向峰从作物育种10大关键点入手，介绍了作物育种4.0以及育种决策模型建立和群体改良策略，并以案例形式系统阐述了数据驱动决策的玉米智能设计育种体系，尤其是从实践角度分享了利用全基因组选择降低育种成本的成果和经验，为玉米生物其余作物育种创新发展提供了新思路。

**链接:**

<http://agri.ckcest.cn/file1/M00/0F/F2/Csgk0GIArvaAXEtoAAjNpkFbcOg827.pdf>

#### **5. 中外专家企业共商饲料行业绿色发展新契机**

**【中国农业科学院】**近日，由中国农业科学院饲料研究所、国家重点研发计划“蓝色粮仓科技创新”重点专项共同主办的第六届国际饲料加工技术研讨会暨中国饲料生产技术创新高峰论坛在深圳市召开。会议以“从零到壹，绿色创新”为主题，特邀国内外动物营养及饲料行业相关科研单位及企业围绕绿色高效单细胞蛋白资源开发、饲料加工装备创新及智能化工厂建设等专题分享了最新研究成果及行业解决方案，为科研单位与企业间搭建了广阔的交流合作平台。与会代表一致认为，单细胞蛋白是潜力无穷的生物资源，具有减排降碳、来源广泛、转化率高等优点，对于解决我国由于饲用蛋白源进口依存度高而可能出现的“卡脖子”问题，助力实现“双碳”目标，进而保证国家粮食安全和经济安全具有重要意义。

**链接:**

<http://agri.ckcest.cn/file1/M00/03/20/Csgk0YZXXvWADnYRAANKxOS-TmM278.pdf>

### 【文献速递】

#### 1. Design and testing of a crop growth sensor aboard a fixed-wing unmanned aerial vehicle

文献源: ScienceDirect,2022-02-05

摘要: The aim of this study is to overcome disturbance of downwash flow field caused by the low-altitude operation of a multicopter unmanned aerial vehicle (UAV) on crop canopies and interference in spectral reflection information of canopies. For this purpose, a crop growth sensor aboard a fixed-wing UAV was developed through flight dynamics simulation analysis of a fixed-wing UAV. This sensor can collect index data on-line and in real-time including: the ratio vegetation index (RVI) of crop leaves, leaf area index (LAI), leaf dry weight (LDW), and leaf nitrogen content (LNC). Flight dynamics simulation analysis of the fixed-wing UAV was conducted by the automatics dynamic analysis of mechanical system (ADAMS) software to obtain the deflection angle of the UAV during flight. According to the flight characteristics and load on the UAV, a ball rolling-type sensor support was designed to ensure that the crop growth sensor is always aimed vertically downwards in-flight. The field test results show that the crop growth sensor aboard the fixed-wing UAV has good dynamic stability and high measurement accuracy. The RVIs measured by the onboard crop growth sensor in the plots and field were fitted with the results measured by a FieldSpec HandHeld 2 spectroradiometer (ASD, Analytical Spectral Device Co., USA). By analysing the fitted results, the coefficients of determination ( $R^2$ ) are 0.763 and 0.833 and the root mean square errors (RMSEs) are 0.16 and 0.17, respectively. By linearly fitting RVIs measured by the UAV with rice growth indices including LAI, LDW, and LNC, the coefficients of determination ( $R^2$ ) are 0.633, 0.581, and 0.528 and RMSEs are 0.18, 0.18, and 0.21, respectively.

链接:

<http://agri.ckcest.cn/file1/M00/03/20/Csgk0YZXZIKARarRAJDqdwFEZAo226.pdf>

#### 2. Increasing energy efficiency with a smart farm—An economic evaluation

文献源: ScienceDirect,2022-02-05

摘要: Rural farms are typically energy-intensive facilities with relatively low energy efficiency. In this sector, the introduction of renewable energies and integrated resource

management technologies has been slower than in the domestic and industrial sector. The introduction of renewable energy sources was an important step in the past, but they are currently insufficient, as they do not allow for adequate energy management. The development of new solutions with integrated energy control is especially attractive for these installations as they present the least limitations in terms of space and adaptation to new technologies. This work describes a solution that was developed and implemented in a farm located in central Portugal. The results show that 83.2% reduction in energy from the grid can be achieved, with 5527 kg CO<sub>2</sub> savings, and the return on investment (of C 32,434) is about 8 years. However, this period can be shortened if evolutionary options are taken, such as upgrading to electric driven agricultural equipment.

链接:

<http://agri.ckcest.cn/file1/M00/0F/F2/Csgk0GIAtHOAWgmBAAvCv7Z9f5w551.pdf>

### **3. Conceptual framework of a decentral digital farming system for resilient and safe data management**

文献源: ScienceDirect,2022-02-05

摘要: Digitization in agriculture is rapidly advancing further on. New technologies and solutions were developed and get invented which ease farmers' daily life, help them and their partners to gain knowledge about farming processes and environmental interrelations. This knowledge leads to better decisions and contributes to increased farm productivity, resource efficiency, and environmental health. Along with numerous advantages, some negative aspects and dependencies risk seamless workflow of agricultural production. Therefore, this study presents the state of the art of digitization in agriculture and points out vulnerabilities in digitized farming processes. The most important are the lack of interoperability and the dependency on internet connection. Hence, requirements are posed to meet these vulnerabilities in future IT (information technology) systems resulting in successive levels of resilience that cover the individual needs of farms adjusted to their mobile and landline internet supply. These findings are incorporated in a conceptual framework for a highly digitized fictive farm. Resilience is ensured by decentralized storage and computing capacities and internet independent communication networks including cooperation with machinery rings and contractors.

链接:

<http://agri.ckcest.cn/file1/M00/03/20/Csgk0YZXY7aAa2xYABDbnDRm-gY090.pdf>

#### **4. Sustainable agrifood supply chains: bibliometric, network and content analyses**

文献源: ScienceDirect,2022-02-05

摘要: Nowadays the agrifood system requires major transformations aimed at promoting sustainability, reducing waste and stimulating a change toward healthy sustainable diets. The scientific literature on the transition to sustainable food models continues to develop rapidly and there is an urgent need to systematize its knowledge structure and thus make future research more vigorous. Recently, several studies have focused on certain aspects of supply chain, such as traceability or decisionmaking frameworks, but a systematic review of the role of sustainability within the agrifood supply has never been carried out. Through a bibliometric analysis combined with network and content analyses, the present study is aimed at identifying homogeneous areas in the field of agrifood supply chains, investigating the role of innovation technology in the transition to sustainability. The bibliometric results showed that sustainable agrifood supply chains are experiencing an evolving positive trend and represent a challenging research topic which is capturing the attention of scholars. From the network and overlay visualization of keyword co-occurrences four different research clusters were identified and the blockchain emerged as central topic in the field of food security and safety. The content analysis highlighted greater attention to the environmental pillar, compared to economic and social pillars of the sustainability paradigm. Lack of studies was also observed on the post-consumption phase of the agrifood supply chain, which could represent a research gap to be fulfilled in the light of circular economy.

链接:

<http://agri.ckcest.cn/file1/M00/0F/F2/Csgk0GIBSamAGq-UABp0ZO9HhaY076.pdf>

#### **5. Farming and Earth Observation: Sentinel-2 data to estimate within-field wheat grain yield**

文献源: ScienceDirect ,2022-02-05

摘要: Wheat grain yield (GY) is a crop feature of central importance affecting agricultural, environmental, and socioeconomic sustainability worldwide. Hence, the estimation of within-field variability of GY is pivotal for the agricultural management, especially in the current global change context. In this sense, Earth Observation Systems (EOS) are key technologies that use satellite data to monitor crop yield, which can guide the application of precision farming. Yet, novel research is required to improve the multiplatform integration

of data, including data processing, and the application of this discipline in agricultural management. This article provides a novel methodological analysis and assessment of its applications in precision farming. It presents an integration of wheat GY, Global Positioning Systems (GPS), combine harvester data, and EOS Sentinel-2 multispectral bands. Moreover, it compares several indices and machine learning (ML) approaches to map within-field wheat GY. It also analyses the importance of multi-date remote sensing imagery and explores its potential applications in precision agriculture. The study was conducted in Spain, a major European wheat producer. Within-field GY data was obtained from a GPS combine harvester machine for 8 fields over three seasons (2017-2019) and consecutively processed to match Sentinel-2 10 m pixel size. Seven vegetation indices (NDVI, GNDVI, EVI, RVI, TGI, CVI and NGRDI) as well as the biophysical parameter LAI (leaf area index) retrieved with radiative transfer models (RTM) were calculated from Sentinel-2 bands. Sentinel-2 10 m resolution bands alone were also used as variables. Random forest, support vector machine and boosted regressions were used as modelling approaches, and multilinear regression was calculated as baseline. Different combinations of dates of measurement were tested to find the most suitable model feeding data. LAI retrieved from RTM had a slightly improved performance in estimating within-field GY in comparison with vegetation indices or Sentinel-2 bands alone. At validation, the use of multi-date Sentinel-2 data was found to be the most suitable in comparison with single date images. Thus, the model developed with random forest regression (e.g.  $R^2 = 0.89$ , and  $RSME = 0.74$  t/ha when using LAI) outperformed support vector machine ( $R^2 = 0.84$  and  $RSME = 0.92$  t/ha), boosting regression ( $R^2 = 0.85$  and  $RSME = 0.88$  t/ha) and multilinear regression ( $R^2 = 0.69$  and  $RSME = 1.29$  t/ha). However, single date images at specific phenological stages (e.g.  $R^2 = 0.84$ , and  $RSME = 0.88$  t/ha using random forest at stem elongation) also posed relatively high  $R^2$  and low RMSE, with potential for precision farming management before harvest.

链接:

[http://agri.ckcest.cn/file1/M00/03/20/Csgk0YZXYW-AJK\\_GAGZTa0EG\\_EM903.pdf](http://agri.ckcest.cn/file1/M00/03/20/Csgk0YZXYW-AJK_GAGZTa0EG_EM903.pdf)

## 6. 基于神经网络算法的果树需水预测研究

文献源: 灌溉排水学报, 2022-01-15

摘要: 准确预测果树需水量。对采集地果园环境数据进行主成分分析, 筛选出影响果树蒸腾量的关键因子。建立以长短时记忆 (LSTM) 神经网络为基础的预测模型来预测果树蒸腾量。为提高预测的精度, 在 LSTM 神经网络的基础上加入了注意力 (Attention) 机

制,形成Attention-LSTM预测模型。将改进的模型与其他模型的预测精度进行对比,仿真试验表明,该模型的预测精度最高,RMSE和MSE分别为0.487和0.062。该预测模型可以准确预测果树蒸腾量,从而实现果园精准灌溉并提高水果产量,具有一定的实际意义。

**链接:**

<http://agri.ckcest.cn/file1/M00/03/20/Csgk0YZXbWWAUJ65ABMJN55WHDQ815.pdf>

## 7. 基于区块链的贝类设施养殖产业资源共享平台

文献源: 海洋科学,2022-01-05

摘要: 针对我国贝类设施养殖产业发展中的资源共享问题,基于农业农村部关于开展贝类设施养殖产业基础数据库建设的相关任务,开发了贝类设施养殖产业资源共享平台。从软件工程的角度,详细论述了贝类设施养殖产业资源共享平台的设计与实现,包括平台的需求分析、业务功能策划、系统设计、基于区块链的平台架构及其实现方法等内容,以期构建稳定可靠、高效实用的贝类设施养殖领域的专业技术服务与资源共享网络平台。

**链接:**

<http://agri.ckcest.cn/file1/M00/0F/F2/Csgk0GIAu22AC8gNABhOICGTdSY785.pdf>

## 8. 土壤细菌多样性空间预测方法对比

文献源: 生态学杂志,2021-12-23

摘要: 为探索适合土壤微生物多样性的空间预测方法,本文以内蒙古中部赤峰市周边为研究区域,采集35个草地土壤样品,利用高通量测序技术,结合从相关网站获取的气候、植被和高程相关数据集,采用多元线性回归(MLR)、普通克里格(OK)、回归克里格(RK)和经验贝叶斯克里格回归预测(EBKR)4种方法,对土壤细菌多样性进行空间预测,并比较其预测精度。结果表明:干旱指数(AI)、年平均降水(MAP)和净光合作用(PSN)是解释土壤细菌多样性变化的最佳环境变量组合;直观来看,4种方法预测的细菌多样性空间分布总体趋势相似,都表现为东南高西北低,但涉及回归的3种方法可以更好地反映细菌多样性的局部变异特征;而MLR、OK、RK和EBKR的留一交叉验证决定系数( $R^2$ )分别为0.408、0.439、0.476和0.638,ME分别为-0.065、0.033、0.017和-0.009, RMSE分别为5.23、5.04、4.95和4.05,表明OK的预测精度稍高于MLR,而整合了辅助环境变量的RK和EBKR的预测精度得到进一步提升,且由于EBKR克服了RK用单一半方差函数概括所有位置数据空间结构的局限性,所以预测精度最高。综上可知,结合辅助环境变量并同时考虑空间结构局部差异的地统计学方法在土壤微生物多样性空间预测中展现出较大潜力。

链接:

<http://agri.ckcest.cn/file1/M00/0F/F2/Csgk0GIAvUWAUwKwABT0cit8L8I587.pdf>

## 9. 后疫情时期中国生猪生产预测与展望——基于自回归XGBoost时序模型的实证研究

文献源: 畜牧与兽医,2021-12-10

摘要: 为了有效保障我国生产市场供给、促进产业健康稳定发展,本文利用自回归XGBoost时间序列预测模型和灰色综合相关模型,对未来五年我国生猪存栏量和猪肉产量进行短期预测,得出存栏量将呈现倒"U"型趋势,预测出猪肉的供应量逐步走向供需稳定的状态。猪肉的价格和餐饮业的发展水平是影响养猪业发展的主要因素,养猪场和乡镇兽医站的发展水平与养猪业的发展密切相关,而鲜(冻)猪肉的进出口量对国内市场影响不大。

链接:

<http://agri.ckcest.cn/file1/M00/03/20/Csgk0YZXbs-AYTbEAAXNh23SBV8305.pdf>

## 10. 融合多源时空数据的冬小麦产量预测

文献源: 农业机械学报,2021-12-07

摘要: 为提高大尺度冬小麦产量预测精度,以2005—2019年河南省遥感数据、气象数据、土壤水分等多源时空数据为特征变量,分析了其与小麦单产的相关性,并基于随机森林算法对特征变量进行了重要性分析,构建了融合多源时空数据的冬小麦产量预测模型。结果表明:增强型植被指数(Enhanced vegetation index, EVI)、日光诱导叶绿素荧光(Solar-induced Chlorophyll Fluorescence, SIF)与高程是小麦产量预测的重要因子,与小麦产量呈高度正相关,对小麦产量预测的重要性指标均超过了0.45,远大于土壤水分、降水量、最高温度、最低温度等因子;基于随机森林算法构建的小麦不同生长阶段产量预测模型中,以10月-次年5月和10月-次年4月为特征变量的产量预测模型精度较高, $R^2$ 分别是0.85和0.84, RMSE分别是832.01 kg/hm<sup>2</sup>和821.55 kg/hm<sup>2</sup>,在空间尺度上,豫西和豫南丘陵山地模型预测相对误差高于平原地区。该研究结果为大尺度作物产量预测提供新的参考。

链接:

<http://agri.ckcest.cn/file1/M00/0F/F2/Csgk0GIAvp-AESGaAA36DEkD5HA081.pdf>

## 11. 基于物联网的浮标水质监测系统与溶解氧浓度预测模型

文献源: 农业机械学报,2021-11-25

摘要: 为促进近海养殖业信息化发展,更好地实现对近海养殖环境的监控,设计了基于浮



标平台的环境监测系统。利用STM32L475微控制器定时采集光照、温度、pH值、溶解氧浓度等信息,通过物联网技术将数据传输至云监测平台,实现了多区域环境信息远程监测和多终端访问。提出了改进遗传算法BP神经网络的溶解氧浓度预测模型,实现对近海养殖环境的预测;根据所采集的数据,利用改进遗传算法对初始权重和阈值进行优化得到最优参数,在此基础上构建BP神经网络溶解氧浓度预测模型。通过试验验证了该系统海洋环境信息采集的准确性与可靠性,以及溶解氧浓度预测模型的有效性;与传统遗传算法BP神经网络预测模型相比,平均误差由0.077 8 mg/L降至0.017 8 mg/L,能够满足近海养殖的实际需求。

链接:

<http://agri.ckcest.cn/file1/M00/03/20/Csgk0YZXb-eAcPzxAAAtV9SehV2g422.pdf>

### 【会议论文】

#### 1. An MLP network based on residual learning for rice hyperspectral data classification

发布源: IEEE

发布时间: 2022-02-04

摘要: In order to classify several kinds of rice (including the rice grown by plasma seed treatment), the datasets of the hyperspectral images of rice were constructed. Due to multilayer perceptron (MLP) does not have the problems of translation invariance and local connectivity, and residual learning can improve the feature extraction ability of MLP network (because of its retaining the original information, preventing the model from degenerating, and facilitating the rapid convergence of the model), therefore, a rice hyperspectral image classification model based on MLP network and residual learning is proposed. The results show that the proposed model has a higher classification accuracy (98.48%), higher than the other common classification models. In addition, the model has been verified on two public datasets with the accuracy values higher than 99.95%.

链接:

[http://agri.ckcest.cn/file1/M00/03/20/Csgk0YZXdiCAYeyCADk7j6\\_N2G8381.pdf](http://agri.ckcest.cn/file1/M00/03/20/Csgk0YZXdiCAYeyCADk7j6_N2G8381.pdf)

#### 2. Joint Plant and Leaf Instance Segmentation on Field-Scale UAV Imagery

发布源: IEEE

发布时间: 2022-02-01

摘要: Monitoring of fields and breeding plots is critical for farmers, plant scientists, and breeders. In this process, a key objective is to assess and monitor the growth stages

together with the number of individual plants on the field. Traditionally, this in-field assessment is performed manually and thus is limited in temporal and spatial throughput. In contrast, vision-based systems offer the potential to assess these traits frequently in an automated fashion on a large scale. The primary target of these systems is to detect and segment each plant and its leaves since this information directly correlates to the growth stage and allows for detailed monitoring. In this paper, we address the problem of automated, instance-level plant monitoring in agricultural fields and breeding plots. We propose a vision-based approach to perform a joint instance segmentation of crop plants and leaves in breeding plots. We develop a convolutional neural network to determine the position of specific plant keypoints and group pixels to detect individual leaf and plant instances. Finally, we provide a pixel-wise instance segmentation of each crop and its associated leaves based on orthorectified RGB images captured by UAVs. The experimental evaluation shows that our method outperforms state-of-the-art instance segmentation approaches such as Mask-RCNN on this task.

链接:

<http://agri.ckcest.cn/file1/M00/0F/F2/Csgk0GIAzC-AWKkDAEUM6shsr6U251.pdf>

### **3. Remote Sensing and Machine Learning Modeling to Support the Identification of Sugarcane Crops**

发布源: IEEE

发布时间: 2022-02-01

摘要: One of the main concerns of agricultural financing institutions is to make sure the loans they grant are used for the stated objective when the loan was requested. Specifically, when Banco Agrario de Colombia grants loans for crop farmers, it schedules verification visits to the cultivation sites to check if the crop stipulated in the loan agreement exists and assess its health. These visits are challenging to make due to the number of visits over vast areas that they need to schedule, lack of trained personnel, and difficulty of access. This article proposes a software tool, based on a machine learning model for processing free satellite imagery, to support the bank's identification of non-compliant crops with the investment plan before making field visits, minimizing the loss of investment by focusing on those areas to prioritize the visits. Sugarcane along the department of Boyacá, Colombia was chosen as the case of study. Free access satellite imagery through the Colombian Data Cube (CDCol) was used and machine learning models were applied on them

to classify the land and predict the presence of the crop, a Random Forest model achieved an overall F1-score of 91% using Landsat-8 imagery and a K-nearest Neighbors model achieved an overall F1-score of 98% using Sentinel-2 imagery.

链接:

<http://agri.ckcest.cn/file1/M00/0F/F2/Csgk0GIAyj6ADGmwAKZoC8v5bHU623.pdf>

#### **4. Mapping Irrigated Area at Field Scale Based on the Optical TRAPezoid Model (OPTRAM) Using Landsat Images and Google Earth Engine**

发布源: IEEE

发布时间: 2022-01-31

摘要: Irrigation is critical to agricultural production in arid and semi-arid regions, and it is imperative to map high-resolution irrigated area to improve water productivity. This study proposes a field-scale (30 m resolution) irrigated area mapping method based on soil moisture change detection using remote sensing data only. First, normalized soil moisture is obtained using the optical trapezoid method (OPTRAM) and then converted to soil water content. Next, individual irrigation events are identified in the time series of soil water content using threshold detection. Finally, irrigation events are accumulated over the time series, and then the irrigated area map can be obtained. This method was tested using Google Earth Engine (GEE) to analyze remote sensing images and map irrigated areas in a typical arid and semi-arid region called Hexi Corridor in northwestern China in the past 30 years. In situ validation shows that this method has an accuracy close to 100%. The shortcoming of low recall is also overcome by long-term observations. Application of the proposed method shows that the irrigated cropland of Hexi Corridor has increased by 4,840 km<sup>2</sup> (42.2%) over a 31-year time period (1990-2020). This field-scale irrigated area mapping method can improve the management of water resources.

链接:

<http://agri.ckcest.cn/file1/M00/03/20/Csgk0YZXe9uAS-5-AEtpa0o9UKo030.pdf>

#### **5. Equity-Ecological Food System Based on Hierarchical Clustering**

发布源: IEEE

发布时间: 2022-01-28

摘要: The modernization of life has witnessed profound changes triggered by human intervention, and currently, the current food system seems to act extraordinarily well.

However, with the technology of agriculture's evolution and the establishment of the world market of the modern economic system, the gap between the rich and the poor still exists, and the nutritional structure between regions is also very different because of the gap between the rich and the poor. The hunger rate still maintains at a high level. Moreover, the ecology of environment is over concerned by experts since the area of cultivated land continue to rise, which substantially increases carbon dioxide emissions. An Equity-Ecological Food System is required extremely, considering the environmental protection and equity. What we urge to do is turn this gorgeous assumption to truth. In order to meet the most basic food needs of our human beings, we should try our best to meet the needs of people's lives and vigorously maintain the current level of enjoyment, reduce the hunger rate and improve the nutritional structure as far as possible. In this paper, apply available information to convert the food system optimization into a new mathematical model and compare it to the old one. Some representative countries are selected by data preprocessing based on hierarchical clustering, which greatly reduces the complexity of the model algorithm. Then we abandon the idea of efficiency and income first in the existing food system, and use (0.8, 0.2) ranking vector to weight the satiety rate and income, and carry out multi-objective programming under the constraints of cultivated land area, per capita daily intake of calories and protein. An improved program is developed through goal planning to optimize the food system in the region to achieve the goals of reducing hunger, improving nutrition and increasing overall efficiency.

链接:

<http://agri.ckcest.cn/file1/M00/0F/F2/Csgk0GIAw9uASQWBAAw8UJF0XzQ791.pdf>

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