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《产业生态学报》

2001年冬, 第5卷第3期, 13-31页

题目: 地理信息系统与过程工程方法在农业产业系统设计中的综合应用

作者: Derya B. Özyurt, Matthew J. Realff

关键字: 生物质精炼, 地理信息系统(GIS), 产业共生, 数学规划, 花生壳, 热解

摘要: 本文提出了一种系统化的构造生态产业系统的方法, 并结合一个以花生壳为原料生产活性碳、胶粘剂前体和氢气的生产过程进行了分析。该方法由三个阶段组成, 包括系统中可能交换的原料的来源和去向; 筛选可能的材料交换和交换设施; 以及以全系统效益最大化为目标的产业生态系统的配置优化。本文以美国佐治亚州的一个农业联合体为背景, 应用地理信息系统(GIS)和数学规划方法设计构建了一个花生壳的加工利用生态产业过程。因为系统中可行的物流和能流连接数目过于庞大, 文中构造了一个连接适宜性等高线, 以便快速地进行筛选优化。

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Combining a Geographical Information System and Process Engineering to Design an Agricultural-Industrial Ecosystem

Derya B. Özyurt and Matthew J. Realff

KEYWORDS:

biorefinery, geographic information systems (GISs), industrial symbiosis, mathematical programming, peanut hulls, pyrolysis

SUMMARY:

A methodology to systematically construct an industrial ecosystem is presented in the context of a specific biomass input of peanut hulls and a process complex of activated carbon, adhesive precursor, and hydrogen. The methodology consists of three phases: locating sources and sinks of potential materials for exchange or upgrading; filtering feasible exchanges, the exchange candidates, and locations for new infrastructure; and generating optimal configurations for the industrial ecosystem based on the objective of maximizing the system benefit, defined in the particular case study as the revenue that is generated by the system. To implement the methodology two computer tools are combined: geographic information systems (GIS) and mathematical programming. A screening problem formulation is developed that uses feasibility contours to help reduce the number of candidate material and energy linkages. A case study describing a prospective agro-industrial complex in the state of Georgia, U.S.A., is given.

《产业生态学报》

2001年冬, 第5卷第3期, 33-48页

题目: 芬兰物流分析: 一个小规模开放经济体中的资源利用实例

作者: Ilmo Mäenpää, Artti Juutinen

关键字: 国内生产总值(GDP), 投入产出分析, 材料强度, 材料流核算(MFA), 总材料消耗(TMC), 总材料需求(TMR)

摘要: 本文分析了1970-1997年期间芬兰的自然资源开发与利用情况。文中用总材料需求(Total Material Requirement, TMR)定量衡量自然资源的使用量, 采取投入产出分析方法重点研究了资源使用与经济结构变化的关系。TMR可被进一步划分为国内材料消费(Total Material Consumption, TMC)与总材料出口需求(Total Material Requirement of Exports, TME)。分析表明, TMR存在着重复计算的问题, 如果将各国的TMR做简单加和, 则世界的贸易总量将翻番, 因为一种资源从一国出口到另一个国家的过程中被计算了两次。而TMC则不存在这方面的问题。对一个类似芬兰这样的小型开放经济体来说, 外贸依存度高, TMR与TMC之间的差异也较大。1997年, 芬兰的TME约占其TMR总量的一半; 从1970到1997年, 芬兰的TMC基本保持不变, 该国TMR的增长主要源于TME的增长。

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Materials Flows in Finland: Resource Use in a Small Open Economy

Ilmo Mäenpää and Artti Juutinen

KEYWORDS:

gross domestic product (GDP), input-output analysis, material intensity, materials flow accounting (MFA), total material consumption (TMC), total material requirement (TMR)

SUMMARY:

In this article, the development of natural resource use in Finland during the period 1970-1997 is analyzed. In measuring natural resource use, the concept of total material requirement (TMR) is applied. The focus is on the linkages of resource use with the changing structures of the economy. The linkages are studied using input-output analysis. Using input-output analysis, the TMR is further partitioned into resources used for domestic final use or for total material consumption (TMC) and total material requirement of exports (TME). The analysis shows that TMR has the problem of double accounting: if the TMRs of all countries of the world are summed, then international trade would be accounted for twice in the world TMR, once in imports and once in exports of each country. The TMC concept does not have this kind of defect. In a small, open economy like that of Finland, where the share of foreign trade is large, the difference between the TMR and the TMC is also large. We show that by 1997, the TME comprised about half of Finland's TMR and that the growth of the TMR over the study period has been due to the TME only as the TMC has stayed rather constant.

《产业生态学报》

2001年冬, 第5卷第3期, 49-63页

题目: 回用与焚烧, 德国废包装塑料的处理方法之比较

作者: Volrad Wollny, Günter Dehoust, Uwe R. Fritsche, Peter Weinem

关键字: 能量回收, 原料循环, 生命周期评价(LCA), 包装, 聚合物, 废物焚烧

摘要: 回收塑料, 尤其是德国包装废物法中所规定的塑料品, 是使物料得以闭路循环的一个重要环节。1991年德国建立了一个产业基金组织 (Duales System Deutschland) 负责收集处理家用的废包装塑料制品, 并针对混杂的塑料制品开发了不同的回收利用过程。本文基于生命周期分析 (Life-Cycle Assessment, LCA) 方法, 分析了城市固体废物 (Municipal Solid Waste, MSW) 焚烧环境效益与成本效益率, 并首次对德国焚烧炉的成本效益状况及其对能源工业的影响作了调查。调查包括最优化时机, 对能源工业和替代过程的影响, 成本预算和效益评估。

根据 LCA 分析结果, 焚烧 MSW 的环境影响主要取决于能量的回收利用率, 德国现有焚烧厂的回收率约为 39%。由于能量增产的效益很低, 所以不必对焚烧厂作进一步优化。焚烧炉产生的能量可用于供电、供热或供汽, 而且长期看来将主要用来替代天然气而非煤。本文还对塑料焚烧与回收过程作了比较。与填埋相比焚烧过程会产生大量二氧化碳, 而回收则不但会减少二氧化碳排放, 而且可以节能。

塑料焚烧的成本在中远期会下降 30%。现在, 计算出的回收塑料以减排二氧化碳的成本仍然很高, 但很快就会有所下降。通过塑料回收来节能的费用比焚烧要高 50%, 但如果德国近期内能够实现废物自动分捡处理, 这一费用会显著下降。

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Comparison of Plastic Packaging Waste Management Options: Feedstock Recycling versus Energy Recovery in Germany

Volrad Wollny, Günter Dehoust, Uwe R. Fritsche and Peter Weinem

KEYWORDS:

energy recovery, feedstock recycling, life-cycle assessment (LCA), packaging, polymers, waste incineration

SUMMARY:

Plastics recycling, especially as prescribed by the German Ordinance on Packaging Waste (Verpackungsverordnung), is a conspicuous example of closing material loops on a large scale. In Germany, an industry-financed system (Duales System Deutschland) was established in 1991 to collect and recycle packaging waste from households. To cope with mixed plastics, various "feedstock-recycling" processes were developed. We discuss the environmental benefits and the cost-benefit ratio of the system relative to municipal solid waste (MSW) incineration, based on previously published life-cycle assessment (LCA) studies. Included is a first-time investigation of energy recovery in all German incinerators, the optimization opportunities, the impact on energy production and substitution processes, an estimation of the costs, and a cost-benefit assessment.

In an LCA, the total environmental impact of MSW incineration is mainly determined by the energy recovery ratio, which was found on average to reach 39% in current German incineration plants. Due to low revenues from additional energy generation, it is not cost-effective to optimize the plants energetically. Energy from plastic incineration substitutes for a specific mixture of electric base-load power, district heating, and process steam generation. Any additional energy from waste incineration will replace, in the long term, mainly natural gas, rather than coal.

Incineration of plastic is compared with feedstock recycling methods in different scenarios. In all scenarios, the incineration of plastic leads to an increase of CO₂ emissions compared to landfill, whereas feedstock recycling reduces CO₂ emissions and saves energy resources.

The costs of waste incineration are assumed to decrease by about 30% in the medium term. Today, the calculated costs of CO₂ reduction in feedstock recycling are very high, but are expected to decline in the near future. Relative to incineration, the costs for conserving energy via feedstock recycling are 50% higher, but this gap will close in the near future if automatic sorting and processing are implemented in Germany.

《产业生态学报》

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题目: 绿色能源还是有机农业? 利用生命周期评价方法确定闲置土地何去何从

作者: Richard van den Broek, Dirk-Jan Treffers, Marieke Meeusen, Ad van Wijk, Evert Nieuwlaar, Wim C. Turkenburg

关键字: 生物质能源, 能源作物, 土地利用, 生命周期评价(LCA), 有机农业, 冬小麦

摘要: 尽管生物质能源的生产会因占用大量可以用以其他用途的土地而受到限制, 但其仍不失为解决目前全球气候变化问题的一条途径。在土地相对紧缺的前提下, 本文对荷兰的能源作物的环境影响作了评价。

基准系统包括: 传统冬小麦产品和1公顷闲置土地, 采用燃煤发电。利用LCA工具, 本文分析了以下两种情况: (1) 在闲置土地上种植柳树, 利用产出的绿色生物质能源替代传统的燃煤发电; (2) 依照荷兰EKO有机农业标准全部种植小麦, 建立有机农业系统。这样, 每个系统中的功能单元和土地用量都相同。最终的系统比较基于各环境主题的规范化评价。两种情况的环境影响如下: 绿色能源系统在防止酸雨、气候灾变方面表现出色, 同时不存在耗尽不可再生能源的问题。有机农业系统的陆地生态毒性很小, 其海洋生态毒性方面的表现也略占优势。而基准系统的富营养化问题较小。

从环境角度来讲, 选择哪种系统取决于当地哪种环境问题更严重及相关的政策倾向。当气候变化、能量载体损耗和酸雨等问题更为严重时, 绿色能源系统更为有益。反之, 当杀虫剂的毒性是主要矛盾时, 则绿色农业系统更值得选择。

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Green Energy or Organic Food? A Life-Cycle Assessment Comparing Two Uses of Set-Aside Land

Richard van den Broek, Dirk-Jan Treffers, Marieke Meeusen, Ad van Wijk, Evert Nieuwlaar and Wim C. Turkenburg

KEYWORDS:

biomass energy, energy crops, land use, life-cycle assessment (LCA), organic agriculture, winter wheat

SUMMARY:

Bioenergy has a large worldwide potential in future climate change abatement, although its application may become limited by demands for land for other functions. The aim of this study was to make an environmental assessment of the use of energy crops in the Netherlands in a context that incorporates scarcity of land.

A base case system was defined, consisting of conventional winter wheat production, set-aside land (1 hectare, together), and the production of coal-based electricity. Using life-cycle assessment, we compared this system with (1) a green energy system in which willow is cultivated on the set-aside land to replace the coal-based electricity and (2) an organic agriculture system in which the full hectare produces wheat under the Dutch EKO organic agriculture standard. In this way, the functional unit and the amount of land used is the same in each system. The final system comparison was based on normalized scores per environmental theme.

The green energy system scored the best with respect to acidification, climate change, and energy carrier depletion. The organic food system scored best on terrestrial eco-toxicity and slightly better on the mutually related themes of seawater and seawater sediment eco-toxicity. The base case system performed slightly better with regard to eutrophication.

Preferences, from an environmental point of view, for one of the systems should be determined by environmental policy priorities and the severity of local environmental problems. The case studied here shows that when climate change, energy carrier depletion, and acidification are the main drivers behind environmental policy, one should focus not on the extensification of agriculture, but rather dedicate more land to energy crops. Extensification of agriculture would be the preferred system when toxicity from pesticides is considered the main problem.

《产业生态学报》

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题目: 英国 1987-2010 年纸制品消费情况的物流与能流分析**作者:** Eric Sundin, Niclas Svensson, Jake McLaren, Tim Jackson**关键字:** 林产品, 材料流分析 (MFA), 纸浆与纸, 准动态模型, 技术变化, 废纸回收

摘要: 本文分析了 1987 至 1996 年间英国纸浆及纸制品的主要物流过程和相关能源需求。研究发现, 英国纸制品的进口依存较重, 同时上游森林产品的处理过程中能量消耗很大。1987 至 1996 年间, 材料流结构被重建, 因为有效数据显示与废纸回收和系统能量需求有关的所有主要过程都是有计划的。在历史数据的基础上, 根据不同的技术参数、废纸回收率及纸制品需求假定, 预测出了直至 2010 年的英国纸业的材料和能源消耗。结果表明, 与减少纸张消耗和改进技术所获得的效益相比, 具有政策倾向的废纸回收收益不大。同时英国电力供应的结构也决定提高纸浆的进口将有利于世界的能源格局。

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Materials and Energy Flow Analysis of UK Paper Consumption: 1987-2010

Eric Sundin, Niclas Svensson, Jake McLaren and Tim Jackson

KEYWORDS:

forest products, materials flow analysis (MFA), pulp and paper, quasi-dynamic modeling, technological change, wastepaper recycling

SUMMARY:

This article presents the results of a life-cycle materials and energy flow analysis for the pulp and paper cycle in the United Kingdom. Material flows are reconstructed for the period between 1987 and 1996 for all major processes associated with the paper cycle, and system energy requirements are calculated over this period using the best available data. Attention is drawn to the import dependence of U.K. paper demand, and the significant energy requirements associated with upstream forestry processes. The historical trend analysis is then used to model possible future developments in materials and energy consumption until 2010 under a variety of assumptions about process technology improvements, wastepaper utilization rates, and changing demand trends. The results indicate that policy options to increase recycling yield some energy benefits, but these are small by comparison with the benefits to be gained by reducing consumption of paper and improving process technology. The structure of the electricity supply industry in the United Kingdom means that global energy benefits could also be achieved by increasing the contribution from imported pulp.

《产业生态学报》

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题目: 绿色产品设计中的价值创造: 联系产业生态学与商业经营的纽带

作者: Mark Finster, Patrick Eagan, Dennis Hussey

关键字: 经营战略, 面向环境的设计(DfE), 生态设计, 卡诺技术, 知识管理, 产品策略

摘要: 产品的绿色设计能改进一个企业的业务表现, 本文对如何利用 Kano 绿色产品设计技术增进企业的经营战略进行了研究。Kano 是一种始于 20 世纪 80 年代的新产品设计方法, 该方法可将绿色设计和企业经营联系在一起。为将产业生态学和商业关系联系起来, 我们还新引进了一些概念包括“环境的声音”、“环境知识管理”、“环境轮廓”、“环境产品特性”等。

如何协调企业的商业价值和环境价值, 本文从三个方面结合具体的实例作了分析: 首先, 设计者应该确定消费者对产品的业务需求和环境需求; 其次, 应该采取有效途径将消费者的需求转化为具体的环境产品和服务特性; 第三, Kano 技术可使消费者认识这些特性, 从而实现产品绿色设计和企业经营战略的统合。最后, 文中结合通用电气医疗系统(GEMS)的设计实例作了案例分析。

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Linking Industrial Ecology with Business Strategy: Creating Value for Green Product Design

Mark Finster, Patrick Eagan and Dennis Hussey

KEYWORDS:

business strategy, design for the environment (DfE), eco-design, Kano technique, knowledge management, product strategy

SUMMARY:

As organizations practice environmental design, some discover green design positively impacts business performance. This article demonstrates how an organization can employ existing design methods and tools with the Kano technique to craft an environmental product design strategy that enhances its business strategy. These tools expand the toolbox of the industrial ecologist and enable the link between green design and business improvement. The Kano technique was developed in the 1980s to facilitate design of innovative products. We also introduce terminology and concepts such as "voices of the environment," "environmental knowledge management," "environmental profile," and "environmental product attribute" in order to bridge the gap between industrial ecology and business concerns.

To demonstrate how an organization can find the synergy between business value and environmental value, this article describes three activities and their corresponding tools and exhibits their use with industry examples. First, we present techniques by which designers can identify and prioritize customers and stakeholders who voice both environmental and business concerns. Second, we describe how voice-of-the-customer translation techniques can be used to efficiently collect and translate data from these customers and stakeholders into critical environmental product and service attributes. Third, we discuss how the Kano technique can be used to connect green design to business strategy by making visible the variety of stakeholder and customer perceptions of these critical environmental attributes. Examples then demonstrate how those perceptions suggest appropriate approaches for integrating the critical environmental attributes into product and business strategy. Finally, we provide examples based on work done with General Electric Medical Systems (GEMS) to illustrate the design of products that improve environmental performance while adding greater perceived value for numerous customers along material-flow value chains.