



Environmental threats

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Abstract: Main tasks of ecology are determine the safety margin of the planet. Identify the parameters that have the greatest impact on the state of the world. Predict the likely outcomes of current economic and industrial policies. Professor Gaia Herrington concludes that the “standard scenario” is most comparable to the current situation. This has led to the creation of numerous (over 1,500) inventions to reduce environmental threats. Chemists at the New Jersey Institute of Technology have created a new laboratory method to detect traces of PFAS in food packaging, water and soil sample. Most existing models of the terrestrial biosphere that are used to estimate carbon sequestration account only partially or not at all for the complex mechanisms associated with vegetation, and are at the lower end of the complexity spectrum.

Keywords: environmental threats, limits to growth, inventions on ecology.

50 years ago, scientists tried to predict the future of the entire Earth using a computer model. The conclusions of the 1972 report "The Limits to Growth" were frightening - uncontrolled economic growth leads to the collapse of civilization. Few people took the forecasts seriously back then. But now the problems of ecology and sustainable development are being discussed quite vigorously, and the work is being remembered more and more often [1]. The reports in the “Limits to Growth” series were published thanks to the Club of Rome, an informal association of public intellectuals from around the world. The goal of the club is to bring together smart and caring people from different fields and open a space for discussion and research on global issues. The club's ideas were outlined in a 1970 document entitled “The Human Predicament”; searching for structured answers to the growing complexity and uncertainty around the world.” It served as a roadmap for the Limits to Growth project [2]. According to the club members, the research had to fulfill three tasks:

- Determine the safety margin of the planet;
 - Identify the parameters that have the greatest impact on the state of the world;
 - Predict the likely outcomes of current economic and industrial policies.
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The World3 computer model created by the authors of Rimsky is based on system dynamics. Internal feedback loops in the system structure influence the behavior of the entire system. World3 covers the period from 1900 to 2100 and is structured around five variables:

- population;
- Agriculture;
- industry;
- environmental pollution;
- consumption of non-renewable natural resources.

Science journalist Brian Hayes compares World3 to an oil refinery circuit: tanks are connected by pipes, flow through the pipes is controlled by valves, and valves are controlled by feedback signals that depend on the state of tanks or flows elsewhere in the model. Dutch researcher and Club of Rome consultant Gaia Herrington (2022) compares information from the book “The Limits to Growth: A 30-Year Update” and concludes that the “standard scenario” is most comparable to the current situation.

This has led to the creation of numerous (over 1,500) inventions to reduce environmental threats [3-5]. Below are examples of a number of them carried out in recent months.

Eology clear combustible in the forest industry, with briquetting of cereals biomass and lignocellulose waste - HUP9702351 (A1) - Lignin, cellulose and water are bonded by chemical means to plant cells and resist greatly all physical interventions and press-forming. Calcium-oxide powder is used for complete dehydration of all comminuted bio-masses. Dehydration destroys the physical-chemical structure of bio-materials and renders them suitable for the prepn. of fuel briquettes from a biomass of cereal and wood working ligno-cellulose waste (an inexhaustible and renewable energy source).

Ocean scavenger device mounts image capture module in unmanned surface vehicle and aided with image recognition to enable carrier to recognize marine debris at located environment - TW202342852 (A) - An ocean scavenger device comprises an unmanned surface vehicle for capturing images of the environment; and a processing mechanism disposed in the unmanned surface vehicle and capable of receiving the images of the environment captured by the unmanned surface vehicle and recognizing marine debris within the images and, in connection with the marine debris, collecting real-time position information of the unmanned surface vehicle presented at the place, and sending a notification message containing the real-time information to a remote control center. Accordingly, the invention mounts the image capture module (a camera for example) in the unmanned surface vehicle and is assisted with image recognition so that the vehicle can recognize marine debris within the environment and reports the positioning of the marine debris so as to notify related departments going to and treating the large-scaled garbage gathering place. By utilizing effective function of detecting marine debris, original ecology can be automatically dodged to avoid damaging environment, thereby reducing the ocean pollution burdened with environment.

Water environment ecological restoration and purification recycling device - CN220265366 (U) - The utility model discloses a water environment ecological restoration purification recycling device which comprises a circulation box, a rubber ring is fixedly connected to the top of the outer wall of the circulation box in a sleeved mode, a transverse strip is fixedly connected to the inner wall of the circulation box, a connecting block is placed at the top of the transverse strip, and the other end of the connecting block is fixedly connected with a cultivation box. Emergent aquatic plants are planted in the cultivation box, a filter frame is fixedly connected to the middle of the inner wall of the circulation box, a carbon rod is placed in the filter frame, a box body fixedly sleeves the bottom of one side of the

circulation box, and a water inlet pipe fixedly sleeves the top, located outside the circulation box, of the box body; the utility model relates to the technical field of environmental ecology. The ecological restoration, purification and recycling device for the water environment solves the problems that an existing park viewing pool is not running water, so that water in the viewing pool becomes smelly after a long time, people passing by feel uncomfortable, and time and labor are consumed by manual cleaning or restoration.

Purification device for river aquatic ecological restoration - LU504563 (B1) - The invention discloses a purification device for river aquatic ecological restoration, which comprises an intercepting dam, a filter box, an electrolytic box and a water pump; the intercepting dam is arranged in the river channel; a floating bed is arranged on the inner water surface of the upstream river channel, and round holes are formed through the floating bed; the floating bed is provided with assembly grooves, and assembly blocks; the filter box, the electrolytic box and the water pump are all fixedly installed beside the shore base, and one side of the filter box is provided with a suction pipe; a prefilter is fixedly installed at the tail end of the suction pipe, and a first filter screen is arranged on the prefilter. The invention can restore aquatic ecology, reduce the burden of subsequent purification devices, change the width of the floating bed, filter out large impurities.

Zero-excavation double-layer small guide pipe out-of-hole construction method for tunnel portal - CN117307175 (A) - Along with rapid development of an expressway network, a large number of mountainous area tourism expressway projects are paid to implementation, and the typical characteristics of mountainous area expressways are that bridges are connected with one another, tunnels are connected with one another, and bridges and tunnels are connected with one another; a series of problems such as vegetation felling, earthwork excavation and slope instability are certainly brought to the natural ecology of a tunnel portal area



by adopting a traditional tunnel portal in-out mode, and the problems are inconsistent with the original intention of construction of a high-speed tourism to a certain extent. In combination with the existing tunnel construction experience, the construction method of 'zero excavation' 'double-layer small guide pipe outlet' is adopted for outlet of the tunnel portal which is large in line terrain height difference, steep in natural gradient and connected with the bridge and the tunnel, and the problems of construction period, cost and ecological environmental protection of the portal construction can be effectively solved to a certain extent.

Post-generation mask capable of changing skin micro-ecology and preparation method of post-generation mask - CN117298032 (A) - The invention relates to the field of facial masks, in particular to a postbiotic facial mask capable of changing skin micro-ecology and a preparation method of the postbiotic facial mask capable of changing skin micro-ecology. 0.3 to 0.8 percent of 1, 2-hexanediol; and 0.3 to 0.8 percent of p-hydroxyacetophenone. The mask provided by the invention can reduce the number of species on facial skin. In the phylum level, the mask can increase the sum of the relative abundance of actinomycetes, proteobacteria and thick-wall mycophylum, and reduce the probability of psoriasis and other skin inflammatory diseases on the facial skin of people.

Self-repairing promoting device for slope ecology of mining area - CN117256265 (A) - The invention discloses a mining area slope ecology self-repairing promoting device, and belongs to the technical field of mining area slope repairing, the mining area slope ecology self-repairing promoting device comprises a bottom plate, pulleys are mounted at the corners of the lower end of the bottom plate, a height adjusting mechanism is mounted at the upper end of the bottom plate, a mounting box is mounted at the upper end of the height adjusting mechanism, and a moving mechanism is mounted on one side of the mounting

box; a stirring barrel is mounted in the mounting box, and a feeding port is formed in the upper end of the stirring barrel, the stirring mechanism is arranged, and the mechanism drives two groups of stirring rollers to rotate in different directions through cooperation of a motor and a gear, so that the mixing effect of soil and seeds can be further improved, and the mixing efficiency of raw materials is improved; by arranging the height adjusting mechanism, the height of the device can be conveniently adjusted through the height adjusting mechanism, so that the device can adapt to slopes with different heights to be used, and it is guaranteed that the device can be reasonably and conveniently used.

Water quality cruise monitoring device for water ecology - CN220188513 (U) - The utility model belongs to the technical field of water quality monitoring, and particularly relates to a water ecological water quality cruise monitoring device which comprises a floating detection mechanism and a positioning mechanism, the floating detection mechanism comprises a floating plate, a floating ball, a floating box, a spiral propeller and a monitoring component, the floating ball is arranged on the side edge of the floating plate, the floating box is arranged at the bottom of the floating ball, and the spiral propeller is arranged on the floating box. Spiral propellers are arranged on the two sides of the buoyancy tank, and a monitoring component is arranged at the bottom of the buoyancy tank; the positioning mechanism is arranged in an inner cavity of the buoyancy tank, the positioning mechanism comprises a driving part, a winding roll, a suspension wire and a balancing weight, the spiral propeller is used for driving the device to move, so that the monitoring part can move for monitoring, after moving, the driving part of the positioning mechanism works, the winding roll unwinds, the balancing weight falls to make contact with the water bottom, and the position of the device is fixed; the water quality can be conveniently monitored at different positions of the water surface, and dragging and moving are not needed. Method and a broad-

spectrum lidar for the sounding of atmospheric methane - BG113445 (A) - The

present invention relates to a method and a broad-spectrum LIDAR for the sounding of atmospheric methane, and more particularly to a method and a broad-spectrum differential absorption LIDAR for atmospheric methane sounding by means of a powerful pulsed laser diode, and would be applied in the area of LIDARs for atmospheric remote sensing, in meteorology, climatology, ecology, power engineering and agriculture as well as in the exploration of deposits of energy resources. The atmospheric methane sounding method is based on the differential absorption in the atmospheric gases of pulses emitted by laser diodes, and uses direct detection of the reflected laser pulses emitted by a broad-spectrum LIDAR equipped with powerful pulsed laser diodes. The laser radiation entering the receiving optical circuit of the broad-spectrum LIDAR is split into two spectral channels. One of them operates at a wavelength of $1.667 \mu\text{m}$ at linewidth 4 nm and falls in the spectral range of methane, and the other spectral channel transmits some part of the laser line excluding the 4 nm wide central spectral range. When sounding for atmospheric methane, the parasitic background absorption in the atmospheric water vapors that matches the absorption spectra of methane is segregated, and the parasitic absorption in the atmospheric water vapors is balanced in the two spectral channels of the LIDAR. The broad-spectrum LIDAR for atmospheric methane sounding includes one transmitting and one receiving optical circuit. The LIDAR consists of an emitter optical circuit with a powerful pulsed laser diode positioned within the focal length of an optical collimator. The receiving optical circuit is arranged in an optical axis parallel to that of the emitter circuit. It consists of a large-aperture optical lens and a translucent mirror positioned in the optical axis at some distance from the optical lens. The laser beam splitting ratio is inversely proportional to the ratio of the incoming spectral intensities, which defines two spectral channels. One of these spectral channels comprises a narrowband filter with linewidth 4 nm at the basic wavelength of $1.667 \mu\text{m}$, and a photoreceiver positioned within the focus of the laser radiation at

some distance after the filter. The other spectral channel includes a band-pass filter of linewidth 15 nm at 1.667 μm wavelength, a stopband filter positioned as some distance from the band-pass filter followed by a photoreceiver positioned at some distance and in the focus of the laser radiation.

Evaluation method and system of mutual-assistance circulation interaction ecosystem - CN117172610 (A) - The invention relates to an evaluation method and system for a mutual-assistance circulation interactive ecosystem, and belongs to the technical field of natural ecology and social ecology interchange. The method comprises the steps that a sample area is selected, and data collection is conducted on a natural ecosystem and a social ecosystem of the sample area to obtain a natural ecosystem data set and a social ecosystem data set; performing target block division on the natural ecological data set and the social ecological data set to obtain a multi-block cluster; determining an absolute weight of each block cluster, and converting the absolute weight into a relative weight; determining a relation matrix of each block cluster according to the natural ecological data set, the social ecological data set and the relative weight; constructing an evaluation model of the mutual-assistance circulation interaction ecosystem according to the relation matrix; and evaluating the target area through the evaluation model to obtain evaluation data of service value of the mutual-assistance circulation interaction ecosystem.

Rhodococcus qingshengii bacterial strain that degrades imazethapyr and stimulates crop growth - US2023416672 (A1) - The proposed disclosure relates to agricultural microbiology, ecology and biotechnology and is intended for remediating soil contaminated with imidazolinone herbicides and stimulating the growth of planted crops. A Rhodococcus qingshengii bacterial strain deposited under VKPM number Ac-2143 was isolated from an enrichment culture based on rhizosphere microflora of soybeans grown on soil treated with the herbicide imazethapyr. The Rhodococcus qingshengii bacterial strain deposited under

VKPM number Ac-2143 degrades the herbicide imazethapyr and stimulates the growth of crops planted in soil contaminated with imazethapyr. Remote sensing monitoring equipment for cultivated land ecology - CN117054347 (A) - The invention belongs to the technical field of monitoring equipment, and particularly relates to farmland ecology remote sensing monitoring equipment which comprises a bottom plate. A mounting sleeve is fixedly connected to the center of the top surface of the bottom plate, a connecting rod is in threaded connection with the inner wall of the mounting sleeve, and a mounting plate is fixedly connected to the top end of the connecting rod; after a bottom plate is placed at a cultivated land to be detected, a motor is started to drive a recovery wheel to rotate, a connecting rope is wound on a rotating wheel and pulls an impact hammer to move upwards, after the impact hammer moves upwards to a proper position, the motor is closed, and the rotating wheel loses driving force, so that the impact hammer is recovered. At the moment, the impact hammer pulls the connecting rope to enable the rotating wheel to rotate, the impact hammer impacts the connecting ring, so that the ground nail is nailed into the cultivated land, the motor is started repeatedly, the impact hammer impacts the connecting ring repeatedly, and therefore the ground nail is completely nailed into the cultivated land.

Urban ecological stability prediction and evaluation method and system based on umbrella-shaped three-dimensional structure - CN116957348 (A) - The invention discloses an urban ecological stability prediction and evaluation method and system based on an umbrella-shaped three-dimensional structure. The method comprises the following steps: constructing a three-dimensional umbrella-shaped structure urban ecological bearing capacity evaluation index system of a social-ecological-economic ternary system; calculating the index weight of the urban ecological bearing capacity index system; calculating the dispersion degree of the index relative to the base point; evaluating the stability of the corresponding state layer by adopting a two-dimensional node evaluation method; calculating the



weight of each state layer; and the overall urban ecological stability prediction and evaluation are completed through the weight of each state layer. According to the method, an urban ecological bearing capacity index system model is constructed according to the functionality and the structure of an umbrella-shaped three-dimensional structure, and a two-dimensional node evaluation different structural layers of urban ecology; the relevance between the whole and the local part and the relevance between the local parts can be found in a complex system, and the characteristics of the method can be visually shown when the urban ecological stability degree is evaluated. Intelligent multi-ecology complementary breeding system.

Intelligent multi-ecology complementary breeding system CN116868914 (A) - The invention discloses an intelligent multi-ecology complementary breeding system. The system comprises an illumination layer, a fishery layer, a poultry layer, an agricultural layer, a cloud platform for collecting and arranging ecological data of each layer and an optimization controller for optimizing and controlling the ecological data, which are stacked and distributed from top to bottom; the illumination layer is used for converting light energy into electric energy to be used by other layers, and open holes are formed in the bottom of the illumination layer, so that illumination can reach the lower layers; the fishery layer is used for breeding aquatic products and is made of a light-permeable material, so that light can reach the poultry layer and the agricultural layer; the poultry layer is used for breeding poultry, and the agricultural layer is used for planting plants. According to the invention, through solar power generation, green energy supply is realized, and carbon emission of the system is reduced; resources are recycled, garbage generated by the system and economic investment are reduced, the automation degree is high, the labor cost is reduced, and the breeding efficiency is improved; and optimizing the breeding system by using an algorithm and searching for

optimal management, thereby realizing scientific management of the breeding system.

Marks and his colleagues found that the polymer strands of nylon-6 could be broken down into individual units very quickly using a catalyst they developed. It consists of several aromatic hydrocarbon molecules combined with atoms of yttrium, as well as lanthanum and some other similar rare earth metals. To decompose nylon-6, it is enough to melt this polymer and introduce a catalyst into it. As chemists explain, the molecules of the substance they created are arranged in such a way that the rare earth metal atom present in them adheres to the nitrogen and oxygen atoms inside the polymer threads and connects the hydrocarbon chain located between oxygen and nitrogen into a ring. As a result, the nylon-6 thread breaks down into ring-shaped molecules of caprolactam, the substance from which this plastic is made. Experiments conducted by scientists on samples of damaged fishing nets, nylon textiles and plastic bottle caps showed that under optimal conditions, nylon-6 completely decomposes in just a few hours, with 99% of the waste converted into caprolactam, suitable for re-production of polymers. The introduction of this technology into industry, as researchers hope, will make it possible to very effectively and cheaply cleanse nature of the most difficult-to-decompose plastic waste. PFAS, or “forever chemicals,” are synthetic compounds that can take thousands of years to degrade. They are everywhere and can negatively affect people's health.

Chemists at the New Jersey Institute of Technology have created a new laboratory method to detect traces of PFAS [6] in food packaging, water and soil samples in just three minutes or less. The mass spectrometry-based method was up to 100 times more sensitive than standard methods. It can detect PFAS at the parts per trillion level—the equivalent of a drop of water in 20 Olympic-sized swimming pools. The development will allow monitoring contamination of drinking water, soil and consumer goods in real time. A new technique that involves ionization

techniques to analyze the molecular composition of material samples is called paper sputtering mass spectrometry (PS-MS). Scientists say it is 10 to 100 times more sensitive than the current standard testing method for PFAS (perfluoroalkyl and polyfluoroalkyl compounds).

PFAS can be ionized and quickly detected using a high-resolution mass spectrometer, which provides a clear picture of each type of PFAS present and the extent of contamination. For more complex structures, such as soil, the scientists used a related technique, desalting paper spray mass spectrometry (DPS-MS). This method removes salts that typically suppress the PFAS ion signal. Together, both methods greatly improve the ability to find these compounds. The detection limit for PFAS is approximately parts per trillion (1 ppt). This amount can be compared to a drop of water in 20 Olympic-sized swimming pools. In tests, the team was able to detect PFAS in one minute or less by analyzing fragments of food packaging materials, including popcorn paper, instant noodle boxes, and hamburger packaging from two international fast food restaurant chains.

The analysis found traces of 11 different PFAS molecules, including common types that are associated with an increased risk of cancer and immune system suppression, such as PFOA (perfluorooctanoic acid) and PFOS (perfluorooctanesulfonic acid). In the water analysis, the team detected traces of PFOA in samples of local tap water in less than two minutes, while finding no traces of PFAS in samples taken from the university's filtered water fountain. Using DPS-MS, the team also identified two types of PFAS from just 40 mg of soil in less than three minutes. The team's rapid detection method is already being tested for use with advanced PFAS elimination methods being developed at NJIT's BioSMART Center. The technology could impact the monitoring of consumer products, from cosmetics and drugs to fresh and processed food.

More realistic environmental modeling shows that plants may absorb more anthropogenic CO₂ emissions than previously predicted. However, this does not mean that governments can ignore the need to reduce carbon emissions, environmental scientists emphasize. Planting more trees and protecting existing vegetation is not a panacea, but the study highlights the benefits of preserving the terrestrial ecosystem. Photosynthesis is the process by which plants convert CO₂ into sugars that are used for growth and metabolism. It is a natural way to reduce carbon levels in the atmosphere and mitigate the effects of climate change. Increased CO₂ uptake by vegetation is the main reason for the increase in terrestrial carbon capture reported over the past decades. However, climate change may affect this process. It was unclear how vegetation would respond to CO₂ concentrations, temperatures and rainfall levels that would be significantly different from what is observed today. Thus, severe droughts and heat can weaken the absorption capacity of terrestrial ecosystems.

In a new study from Trinity College Dublin, scientists present [7] the results of their modeling, which estimates the impact of climate change on carbon sequestration by vegetation until the end of the 21st century. The study used different versions of the model, taking into account different physiological processes of plants. The simpler version ignored some important mechanisms of photosynthesis, while the most complex version took into account all of these mechanisms. Thus, aspects of the efficiency of the movement of carbon dioxide through the inner part of the leaf, the adaptation of plants to temperature changes and the economical distribution of nutrients in the plant crown were taken into account. These mechanisms strongly influence the ability of plants to regulate the carbon cycle, but are often ignored in global models.

It turns out that more complex models that take into account more plant physiological processes predict significant increases in carbon uptake by vegetation around the world. The effects of these processes were mutually

reinforcing, which means that in real conditions an even greater increase in CO₂ uptake is expected. Most existing models of the terrestrial biosphere that are used to estimate carbon sequestration account only partially or not at all for the complex mechanisms associated with vegetation, and are at the lower end of the complexity spectrum. This means that scientists are underestimating the ability of vegetation to adapt to climate change. However, simply planting trees will not solve all problems. Scientists emphasize the need to continue reducing emissions across all sectors. We have to hope that the joint efforts of scientists and inventors will lead to a significant reduction in environmental threats.

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References

1. 15 Biggest Environmental Problems of 2024. URL: earth.org/the-biggest-environmental-problems-of-our-lifetime/
2. Benatar David. The Human Predicament (book). Oxford University Press. 2017. 288 p.



3. Oyebanji, M. O., Castanho, R. A., Genc, S. Y., & Kirikkaleli, D. Patents on environmental technologies and environmental sustainability in Spain. Sustainability. 2022. V. 14. №. 11. P. 6670.

4. Kirikkaleli D., Sofuoğlu E., Ojekemi O. Does patents on environmental technologies matter for the ecological footprint in the USA? Evidence from the novel Fourier ARDL approach. Geoscience Frontiers. 2023. V. 14. №. 4. P. 101564.

5. Can patents help save the environment? URL: minesoft.com/can-patents-help-save-the-environment/

6. Jenkins Jesse. NJIT Researchers Unveil Method to Detect 'Forever Chemicals' in Under 3 Minutes. URL: news.njit.edu/njit-researchers-unveil-method-detect-forever-chemicals-under-3-minutes

7. New lab allows scientists to test impacts of climate change in precisely controlled infrastructure. URL: tcd.ie/news_events/articles/2024/new-lab-allows-scientists-to-test-impacts-of-climate-change-in-precisely-controlled-infrastructure.

8. Shilov Anton. High-tech companies led PCT patent applications last year. URL: tomshardware.com/tech-industry/china-filed-25-more-patents-than-the-us-in-2023-banned-huawei-led-all-companies-worldwide-despite-heavy-us-sanctions/

Дата поступления: 20.02.2024

Дата публикации: 26.03.2024