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Decision Support System Tool Development for Evaluate and Categorize Threatened Species in Greece

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Abstract : *This paper describes the development of a Decision Support System Tool for evaluate and categorize threatened species in Greece. This application is used to determine which species require more conservation measures. Is a powerful tool for environmentally sustainable management that aims to enable the use of hypothetical scenarios. This article describes the development of an application software for citation and assessment of species in Greece using IUCN red list categories and criteria. The IUCN Red Lists are widely recognized as effective methods for species conservation. The overall objective was to design and develop application software that would assist scientists in estimating the potential risk of a species, or even a subpopulation of a species. The application software's key benefits include its intuitive graphical user interface, practical usability, extensibility, and functionality that do not require special knowledge of informatics. Finally, this application software's primary accomplishment is to advance scientific research in the field environmental sustainability.*

Keywords: *decision support system, threatened species, development, sustainability*

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I. Introduction

Global warming and climate change have been elevated to the frontline of society in the last few years and have become a frequent topic of discussion in global society. Green ICT has emerged as a critical management issue in this context. Green ICT refers to initiatives and strategies that aim to reduce technology's environmental footprint[1].

Environmental informatics is a relatively new term in the field of information technology that refers to environmentally sustainable environmental technologies (ICTs) that benefit the natural environment and promote sustainable development. It combines cutting-edge tools, e-services, and smart technologies with environmentally friendly practices. As a result, the term "green ICT" has come to refer to environmentally friendly technologies and software tools[2,3].

The development and use of smart tools in the field of environmental science has advanced significantly in recent years, owing primarily to technological advancements in the computer sector, particularly the programming and use of specialized software that serves as the technological foundation for such projects[4,5.]

Sustainable use and management of biodiversity in the environment will require data, which should be made available to scientists whenever and wherever decision-making will require it[6,7].

The IUCN Red Lists are widely recognized as effective tool for the conservation of threatened species [8]. Established in 1948, the IUCN Red List of Threatened Species is the most comprehensive index of the world's natural state of species, plant, and animal protection [9]. The organization is the primary authority for recording and evaluating species' physical protection. Additionally, a series of regional red lists are produced by states or organizations to assess the risk of species extinction within the constraints of their policy management. The IUCN Red List is based on precise criteria that evaluate the extinction risk of thousands of species and subspecies. These criteria apply to all species and regions worldwide. The goal is to communicate to the public and policymakers the urgency of conservation issues, as well as to assist the international community in its efforts to reduce species extinction[10–12].

Environmental sustainability is a critical component of developing government strategies on a global scale. Managers are gravely concerned about the availability of environmental resources, and this reality has resulted in the development of sustainability policies and plans aimed at preserving and controlling their use. Thus, decision making is the process of selecting the most effective course of action from a set of alternatives in order to succeed in today[13,14]. Both governmental and non-governmental organizations increasingly rely on the

IUCN Red List to inform conservation priorities, influence legislation, and guide conservation investment, especially as its influence continues to grow[15].

Environmental protection and green energy are top priorities in a quantity of countries today. The sector of information and communication technologies (ICT) has become increasingly recognized as critical to ensuring sustainable development. Since the 2000s, information and communication technology has been a critical component of this path[16].

Globally, pressures on environmental resources are increasing as a result of climate change's consequences. Adaptable tools and methods are required to elucidate data, foster comprehension, and develop strategies for their long-term use and management. These tools are intended to aid scientists, natural resource managers, and policymakers[17].

The purpose of conducting this research is to design and develop a decision support software tool that will assist scientists in making sustainable development management decisions by automatically evaluating and categorizing threatened species.

II. Material and Methods

The object-oriented programming language C# with the NET Framework was used to develop the application software with Microsoft Visual Studio, as development software package, and Microsoft Access, as relational database management system. The application software consists of an efficient application that can be used during the assessment process in the context of sustainable environmental management, with the goal of enabling the use of hypothetical scenarios.

This work to create a DSS was conducted out in a logical sequence of steps and is based on a technique known as "system development life cycle." SDLC. The developer has the ability to revert to a previous stage of development in this technique. These phases were as follows: a) Identify the Problem - Define Objectives, b) Design the Data Management Subsystem and Model, c) Management Subsystem, d) User Interface Subsystem Design, and e) Final application.

Hypothetical scenarios are derived from simulations of the interventions' effects and are based on "what-if" logic in which alternative input values result in alternative output values. The application software's operation is dependent on the relationship between the data received from the specialized user/administrator and the outputs sent to him. Additionally, the application software was developed using the latest version 3.1 of the IUCN Criteria, as amended and stamped in the Greek Red Data Book of Endangered Animals[18]. There are a variety of quantitative criteria for listing as Critically Endangered, Endangered, or Vulnerable. While the IUCN Red List of Threatened Species is far from perfect or exhaustive, it remains true to its original mission of providing the most comprehensive and scientifically rigorous information possible about the conservation status of species[8,19].

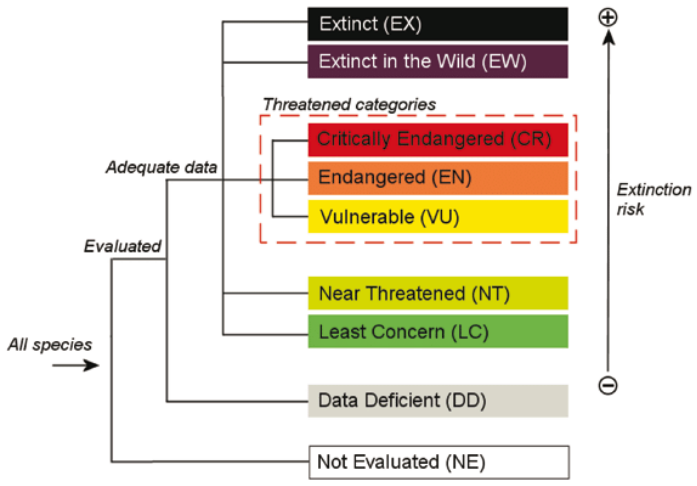

Figure 1. The nine IUCN Red List Categories.

A taxon that meets even one of these criteria is eligible for listing at that threat level. Each taxon should be compared to all of the criteria. While some criteria will be inappropriate for certain taxa, there should be criteria applicable to determining the threat level of any taxon.

The critical factor is whether any one of the criteria is met, not whether all of them are appropriate or met. Because it is impossible to predict which criteria will apply to a given taxon in advance, each taxon should be evaluated against all criteria, and all criteria met at the highest threat category must be listed.

III. Results

This application is an assessment tool that is based on the IUCN-established system (International Union for Conservation of Nature). Additionally, it distinguishes between endangered and extinct species and identifies the major threats and the most effective measures for protecting and conserving those species.

The user is prompted to respond to a series of quantitative criteria and options in order for the software to determine the likelihood of extinction of a species, or even a sub-population of a species. This application software is used to determine which species require more conservation measures. More precisely, the application software uses five quantitative criteria to determine whether a species is threatened and then assigned to one of the categories (CR, EN or VU).

These criteria are based on population biological parameters. The total population size of the species under consideration, its distribution, and an assessment of the intensity and extent of threats to the species and its habitat, as well as other biological elements, are used for this purpose.

The following five criteria were used: (a) Distribution reduction (b) Distribution restriction (c) Environmental degradation (d) Biotic process disruption (d) Quantitative analysis. To conclude our description of the application software tool, we should mention that it is composed of seven sub-screens, the last of which displays the evaluation's final result.

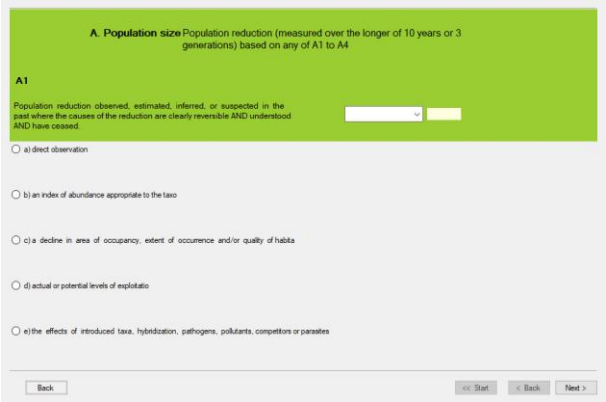

Figure 2. DSS TOOL, Parameters and Citations and Assessment forms

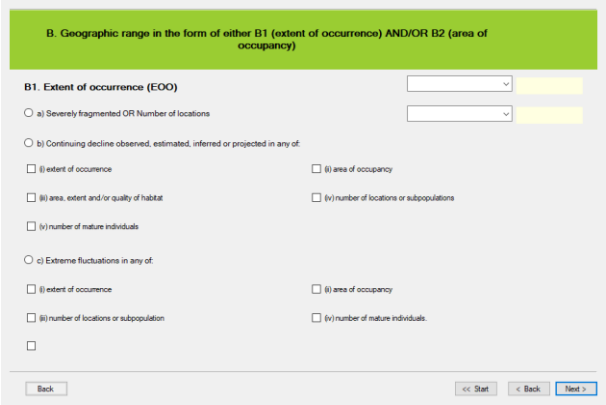

Figure 3. DSS TOOL, Parameters and Citations and Assessment forms

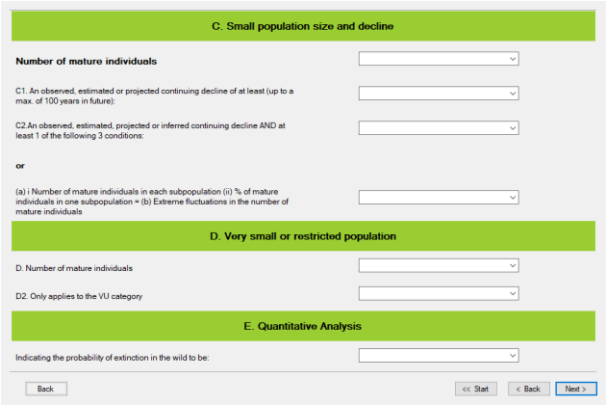

Figure 4. DSS TOOL, Parameters and Citations and Assessment forms

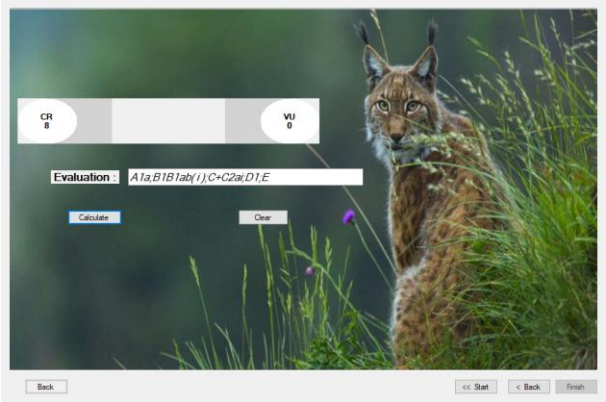

Figure 5. DSS TOOL, Parameters and Citations and Assessment forms

IV. Conclusion

Due to changing objective needs, decision making has become a much more complex process than in previous decades. Managers operate in a more complex and rapidly changing environment. As a result, decision makers must employ more effective tools and techniques that aid in the decision-making process and reduce the likelihood of making errors. These are unquestionably Decision Support Systems.

As a result, the sector of green informatics creates the necessary conditions for a more effective resolution of environmental issues, thereby contributing to the advancement of human culture and living standards while also improving the overall quality of life in society. Overall, this study concludes that Green ICT is necessary for the continued viability of ICT in the future, as well as an innovative method of utilizing ICT for environmental protection. Finally this application is also an excellent tool.

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