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BIODIVERSITY LOSS, THE CAUSES, THE STATE AND BASIC FORM OF NATURE PROTECTION IN SPAIN AND POLAND

The loss of biodiversity is a huge problem over recent years and is expected to continue. This is mainly due to human activity. Causes can be divided into direct; such as land use, pollution or climate change, and indirect, including demographic factors as well as economic and government issues. In order to avoid a further decline of biodiversity, nature conservation is undertaken, which plays a key role in preserving natural ecosystems. The aim of this review was to show the problem of loss of biodiversity and to compare the structure of nature conservation forms in Spain and Poland.
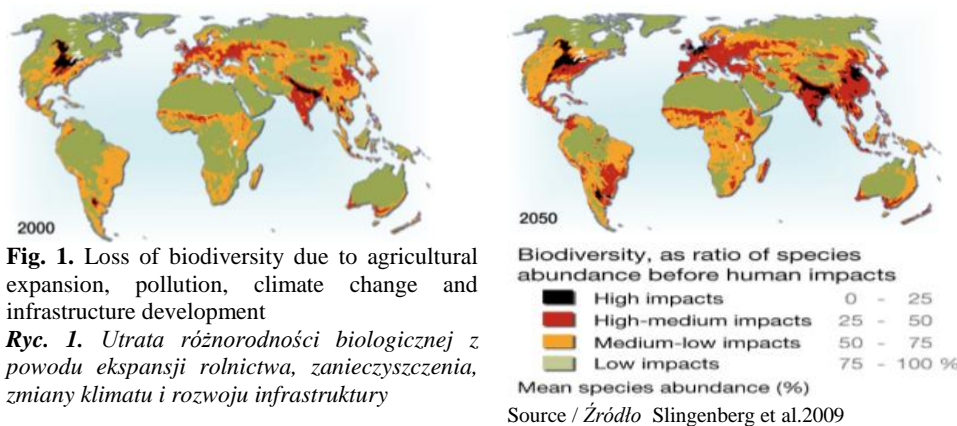
Key words: biodiversity loss, causes, state, nature protection forms

I. INTRODUCTION

Biodiversity can be defined as variety of life on Earth. This term includes variation among genes, species as well as functional traits. It is often measured as: richness which measure the number of unique life forms; evenness which corresponds to a measure of equitability among life forms; and heterogeneity which is the dissimilarity among life forms [Cardinale et al. 2012]. As can be seen in Figure 1, biodiversity has decreased during recent years and is expected to continue during the following ones at unprecedented rates as human development and expansion leads to loss and fragmentation of natural habitat for flora and fauna species. Some projections estimate a reduction from 70% in 2000 to about 63% by 2050 and even much more by 2050 [Slingenberg et al. 2009, Newbold et al.2016].

Biodiversity maintenance is essential for keeping many of the ecosystem services such as food production, nutrients' recycling, biological control of populations of flora and fauna or use of genetic resources [Slingenberg et al. 2009, Mace et al. 2012]. Consequently, in this review we will explore the different causes of biodiversity loss followed by different measures that could be applied in order to protect our nature.

The aim of this review was to show the problem of biodiversity loss and to compare the structure of nature conservation forms in Spain and Poland.

Fig. 1. Loss of biodiversity due to agricultural expansion, pollution, climate change and infrastructure development

***Ryc. 1.** Utrata różnorodności biologicznej z powodu ekspansji rolnictwa, zanieczyszczenia, zmiany klimatu i rozwoju infrastruktury*

Biodiversity, as ratio of species abundance before human impacts

■ High impacts	0 -	25
■ High-medium impacts	25 -	50
■ Medium-low impacts	50 -	75
■ Low impacts	75 -	100 %

Mean species abundance (%)

Source / *Źródło* Slingenberg et al.2009

II. CAUSES OF BIODIVERSITY LOSS

Most of the pressure on diversity is related with human activities as they have greatly altered the environment during decades [ENI 2008]. The main causes of biodiversity loss can be classified into two main groups: direct and indirect causes.

Direct causes

Land use

Related with changes that take place in the landscape as a consequence of some activities such as agriculture, fishing, demographic expansion or deforestation leading to loss and fragmentation of the natural habitat. This is considered the most important cause of biodiversity loss [Slingenberg et al. 2009, Krauss et al. 2010]. Table 1 provides data of human disturbance of habitats on a worldwide scale. The data show a high impact of human activity on natural ecosystems. For example, in Europe only 15.6% is considered as undisturbed being the lowest percentage after Antarctica [Hens and Boon 2004].

Table 1 – *Tabela 1*

Human disturbance in habitats by continent / *Zakłócenia siedlisk przez ludzi na kontynentach*

Continent *Kontynent*	Area / *Powierzchnia* (km²)	1	2	3
		(%)		
Europe	5 759 321	15.6	19.6	64.9
Asia	53 311 557	43.5	27.0	29.5
Africa	33 985 316	48.9	35.8	15.4
North America	26 179 907	56.3	18.8	24.9
South America	20 120 346	62.5	22.5	15.1
Australia	9 487 262	62.3	25.8	12.0
Antarctica	13 208 983	100.0	0.0	0.0

1.Undisturbed: primary vegetation and very low human population density
2.Partially disturbed: shifting or extensive agriculture; secondary but naturally regenerating vegetation; livestock density overcarrying capacity; other evidence of human disturbance
3.Human dominated: permanent agriculture or urban settlement; primary vegetation removed; records of permanent degradation
1. Nie zniszczone: pierwotna roślinność i bardzo niska gęstość zaludnienia
2. Częściowo zniszczone: wędrowne lub ekstensywne rolnictwo; wtórna, ale naturalnie regenerująca się roślinność; gęstość chowu inwentarza żywego powyżej pojemności środowiska; inne negatywne antropopresje
3. Dominacja ludzi: rolnictwo lub osadnictwo miejskie; pierwotna roślinność usunięta; zarejestrowana trwała degradacja

Source / *Źródło* Hens and Boon 2004

An example of the consequences of the changes in the habitats can be observed in the Mediterranean Sea. *Posidonia oceanica* is an endemic marine plant located in the region. Among its advantages we have oxygen production (between 10-15 litres per day), protection of the sea coast acting against currents and waves as well as protection and feeding of many species. Due to fishing mainly, its population has been affected and if it disappears, some effects will be loss of biodiversity, increase in coastal erosion and changes in the trophic network [ENI 2008].

Pollution

This affects the natural environment producing negative effects which alter the energy flow as well as the physical and chemical constitution of the environment. Furthermore, it also changes distribution of species. Examples can be found in water and air pollution [ENI 2008, Hens and Boon 2004].

Climate change

Climate change affects either distribution and abundance of species sometimes causing extinction. It is closely related with biodiversity because by conserving the latter one, the impacts of the former can be reduced due to ecosystems crucial role in the global carbon cycle and in climate change adaptation. It corresponds to one of the Millennium Development Goals [Slingenberg et al. 2009, Skogen et al. 2018].

Introduction of exotic species

Invasive species can be defined as organisms that cause either ecological or economic harm in a new environment where they are not native [Beck et al. 2006]. Exotic species have been considered as the second most relevant threat to global biodiversity loss [Slingenberg et al. 2009].
Some can be accidental such as in case of weeds and insect pests, however, humans induce the majority of the cases (it has been estimated that we are responsible for approximately 20% of the cases of mammals and birds extinction) [ENI 2008, Hens and Boon 2004]. The reasons are diverse: competition for limited resources, predation of new species, diffusion of disease, damage in endemic vegetation. An example of that could be exposed with *Trachemys scripta elegans*, a turtle endemic to the USA that was sold through the pet trade. As they became too large, people started to release them into ponds or lakes. As a consequence, this species began to compete with the European pond turtle *Emys orbicularis* [Martínez-Silvestre 2015]. Currently some measures have been taken in order to protect endemic species from adverse effects of invasive species which include the Agreement on the Applications of Sanitary and Phytosanitary Measures (the SPS Agreement), signed in 1994 during the negotiations of the World Trade Organization [Slingenberg et al. 2009, National Geographic Society 2011].

Genetic modified organisms (GMOs)

GMOs are plants or animals whose genes have been scientifically changed, in that way it is possible to create organisms with concrete desired characteristics [Cambridge dictionary 2018]. Regarding the harmfulness of these organisms there is a violent debate between those that support them and those who claim that they could be involved in transmission of resistance genes and disappearance of species. Examples of GMOs are found in transgenic maize which contains the Bt gene of *Bacillus thuringiensis* providing this plant resistance to some harmful insects [ENI 2008, Koziel et al. 1993].

Overexploitation of resources

This takes place when activities connected with capturing and harvesting a renewable natural resource in a particular area is excessively intense. In that way the resource itself becomes exhausted [ENI 2008 Scott 2018]. This is the case of *Bluefin tuna*, a tuna specie considered a delicacy in sushi. A kilo of its much sought-after meat can bring in prices reaching 130 Euros at fish auctions, so fishermen do not allow them time to reproduce properly [Slingenberg et al. 2009, Coleman and Williams 2002].

Indirect causes

Demographic factors

During the last century, the Earth has experienced a fast grow of the population, as we can see in Table 2 population passed from 3 billion in 1960 to 5.4 billion by 1990 and some projections indicate that global population will achieve 8 billion in 2025. Growth of population implies an increasing demand for food and building material putting more pressure on existing natural resources [Slingenberg et al. 2009, Hens and Boon 2004].

Table 2 – *Tabela 2*

Estimation of Human population growth by continents / *Wzrost populacji ludzi na kontynentach*

Continent / *Kontynent*	1960	1990	2025	2100
World population / *Populacja światowa* (bilions / *miliardy*)	3.0	5.4	8.1	12.0
	(%)			
Asia/Oceania	57.0	59.4	58.6	57.0
North and South America	13.3	13.7	12.8	11.0
Africa	9.2	11.9	20.9	23.9
Europe	20.5	15.0	7.7	8.1

Source / *Źródło*: Hens and Boon 2004

Economic factors

First, market failures need to be taken into account. They can be described as the inability of markets to capture the costs of transforming ecologically valuable land to other uses and losing biodiversity in the process [Slingenberg et al. 2009, Gowdy 1997]. Setting a global value for biodiversity is a difficult task as species can have value as commodities (if they can be sold or bought in the marketplace), amenities (if their existence improves live in a nonmaterial way) or moral [Wilson 1988]. One of the main problems in connection with biodiversity loss is that much of the biodiversity value cannot be used directly so features such as aesthetic appreciation or genetic information are usually in disadvantage in the economic market. Furthermore, there are some studies that claim that the higher the economic growth of a country, the higher biodiversity loss [Slingenberg et al. 2009, Dietz and Adger 2003].

On the other hand, statistical comparisons between different countries reveal that the size of the economy relative to the country are (economic footprint) together with income inequality are good predictors of endangered species. In the end, what occurs is that developed countries and private sectors usually exploit and extract natural resources from underdeveloped ones in order to satisfy the current market demand (in a legal or illegal way) producing in some cases over-harvesting of species [Mikkelson et al. 2007, Wilson 1988].

Institutional drivers

Institutional and governmental factors are considered as crucial to improve biodiversity policies. Although the major part of the western countries have a legislative framework, it

is far from being successful due to ineffective governance structures as well as lack of adequate property rights.

Property rights

Property rights in relation with natural resources include privileges and responsibilities when using environmental services and benefits controlling either use and conservation of natural resources. Currently most of property right systems include mainly direct uses and are defined for single species. As a consequence, form and function of property rights in relation with biodiversity is still in development due to lack of enough knowledge about the benefits of well-functioning ecosystems or interest to promote and keep them [Slingenberg et al. 2009, Lerch 1998].

Governance

Includes problems at different levels.

International level: It is often considered the most significant problem due to its fragmented nature and failure when trying to integrate environment together with development policy ("integration failure"). Furthermore, at this level implementation and control are difficult to realize because it is complicated to force stakeholders and nations to consider the legislation seriously [Hens and Boon 2004, Arjjumend et al. 2016].

National level: Problems related with quality of legislation, adequate policy methods, money or organization can be found. High levels of political corruption are present in many developing countries, which decreases the needed founding for nature conservation. In addition, some multinational companies or institutions have more power compared with national government, which contribute to serious degradation of natural resources [Slingenberg et al. 2009, Navjot 2008].

Regional level: The importance usually varies depending on the region but similar problems to those previously described can appear for example lack of money, regulation or corruption as in some cases the share of responsibilities is no clearly distributed [Slingenberg et al. 2009, Willis 2017].

III. NATURE PROTECTION

As has been seen at the beginning of this review, taking care of our biodiversity is essential. In order to protect it several methods can be used for example:

In-situ methods

Related with protection of species in their natural habitat from human activities. This is considered the most appropriate way of biodiversity conservation and can be achieved by creation of natural protected areas which are defined as "terrestrial or aquatic portions of the country, the nature of which has not been greatly altered, that are designated for the purpose of protecting the diverse ecosystems represented within". Some examples are National Parks, Biosphere Reserves or animal sanctuaries [Wanjui 2013, Urquiza 2009].

Ex-situ methods

This is a conservation technique involves maintenance of biodiversity outside the natural habitat. In general, it is a measure applied to complement the in-situ conservation and includes different activities, from keeping captive population to awareness, education or investigation. Among the different methods, we can mainly distinguish zoos, botanical gardens and gene banks [Wanjui 2013, Geda 2013].

Laws and Strategies
a/ Biodiversity Strategy

Strategy adopted in 2010 by the European Union in order to stop the loss of biodiversity by 2020 by setting 6 targets and 20 actions. Among its actions included financing, partnership with private stakeholders and civil society and actions to better monitor and report and to improve knowledge. A progress has been observed but still more effort it is needed [EUROPARC- EU 2020- 2017].

b/ Habitats Directive 1992

Protection of natural habitats as well as wild flora and fauna across Europe allowing the countries to follow the same legislative framework. It protects in total over 1000 vulnerable animals and plant species together with 200 types of habitat [European Commission 2016].

c/ Natura 2000

It corresponds to a network of resting sites for both, rare and endangered species as well as habitat protection (that are listed in Birds Directive and Habitats Directive) in their own. It works around the 28 EU countries either land or sea. Natura 2000 is not a system of strict natural reserves due to in some places human activities are taking place but in a sustainable way [Ministerio para la Transición Ecológica… 2018].

d/ Green infrastructure Strategy

Related with a network of natural and semi-natural areas for improving environmental conditions and citizens' health and life quality [Benedict and McMahon 2006.].

IV. MAIN STRUCTURES OF NATURE PROTECTION IN SPAIN

Spain corresponds to one of the most biodiverse countries in the EU by having 3 822 protected areas including 15 National Parks, 151 Natural Parks, 290 Natural Reserves, 346 Natural Monuments, 57 protected landscapes 1 865 Natura 2000 1 Marine Area and a numerous number of developed figures by the autonomic communities (table 3). Andalucía is the community with higher protected surface, followed by Cataluña. On the other side, Murcia is the community with less protected surface. Nature Protection in Spain is based on several laws such as Law 33/2015 of Nature Heritage and Biodiversity, Law 30/2014 of National Parks or Law 26/ 2007 of Environmental responsibility [EUROPARC- España 2016].

Table 3 – *Tabela 3*

System of nature protection Forms in Spain / *System form ochrony przyrody w Hiszpanii*

Form of protection *Forma ochrony*	Number *Ilość*	Total surface *Powierzchnia ogółem* (ha)	Terrestrial surface *Powierzchnia lądowa* (ha)	Marine surface *Powierzchnia morska* (ha)
National Parks	15	384 919	368 931	15 988
Nature Parks	151	4 028 716	3 955 680	73 036
Nature Reserve	290	169 165	158 649	10 516
Nature Monument	346	88 229	88 111	118
Protected Landscape	57	151 711	151 711	-
Marine Protected Area	1	234 950	-	234 950
Natura 2000	1 865	22 360 000	13 800 000	8 560 000
Others	1 098	2 518 423	2 359 817	158 606

Source/ *Źródło*: EUROPARC-España 2016

V. MAIN STRUCTURES OF NATURE PROTECTION IN POLAND

Poland biodiversity is also among the richest in Europe and contains more than 3 000 of protected areas forms, including 23 National Parks, 1494 Nature Reserves, 122 Landscape Parks, 402 Protected Landscape Areas, 994 Nature 2000 Areas (and also 175 Documentation Sites, 7602 Ecological areas and 256 Landscape – Nature Complexes) (tab. 4).

These forms of nature protection cover areas, resources, creations and elements of nature on the basis of the Polish Nature Conservation Act [Ustawa o ochronie …].

Table 4 - *Tabela 4*

System of Nature protection Forms in Poland / *System form ochrony przyrody w Polsce*

Form of protection *Forma ochrony*	Number *Ilość*	Total surface *Powierzchnia ogółem* (ha)	% of overall country area *% całkowitej powierzchni kraju*
1.National Parks / *Parki narodowe*	23	314 600	1.0
2. Nature Reserve / *Rezerwaty przyrody*	1 494	164 500	0.5
3. Landscape Parks / *Parki krajobrazowe*	122	2 529 600	8.1
4. Protected Landscape Areas / *Obszary chronionego krajobrazu*	402	6 992 500	22.4
5. Natura 2000 areas	994	5 571 200	17.8
6. Monuments of nature / *Pomniki przyrody*	30 925	-	-
7. Documentation sites / *stanowiska dokumentacyjne*	175	94 900	0.3
8. Ecological areas / *Użytki ekologiczne*	7 602	900	0.0
9. Landscape-nature Complex / *Zaspoły przyrodniczo-krajobrazowe*	256	51 700	0.2
10. Plants, animals and fungi species protection / *Ochrona gatunkowa roślin, zwierząt i grzybów*	715 plants 322 Fungi 799 animals		

Source / *Źródło*: Generalna Dyrekcja … 2017, Ciarkowska et al. 2014

Data in points 1-9 - Source: Central Register of the Forms of Nature Protection, *crfop.gdos.gov.pl* (July 6th, 2017); Data in points 10 - Source: General Directorate for Environmental Protection (January 2015) - Data refer to native species / *Dane w punktach 1-9 - Źródło: Centralny Rejestr Form Ochrony Przyrody, crfop.gdos.gov.pl (6 lipca 2017 r.); Dane w punktach 10 - Źródło: Generalna Dyrekcja Ochrony Środowiska (styczeń 2015 r.) - Dane odnoszą się do gatunków rodzimych*

VI. COMPARISON OF NATURE PROTECTION FORMS BETWEEN POLAND AND SPAIN

As has been seen, each country has a particular way for preserving nature. Protected areas in Poland are more numerous in comparison with Spain (41 993 in front of 3 822- without considering individual species protection). However, if we only take into account the total protected area in both countries we can observe that Spain doubles the number of

ha present (15 749 900 compared with 29 936 113). An explanation for this could be that in Poland many individual objects of animate and inanimate nature are protected. Taking a close view of Poland, it can be seen that most of the territory corresponds to Protected Landscape Areas followed by Natura 2000 areas and finally Landscape Parks. The main difference between Landscape Areas and Parks resides in the fact that Parks have a recreational purpose and are more urbanized areas. Regarding Spain, almost all protected land belongs to Natura 2000, then comes Natural Parks, which are conserved natural areas controlled by autonomic governments in which human activity is controlled in contrast with National Parks; which are more extensive, less transformed and controlled by the National government [EUROPARC- España 2016] followed by the group called "Others" that includes protected areas from the different autonomous regions. One aspect to highlight is also the presence of Marine Protected Areas, which lay under Law 33/2015 of Nature Heritage and Biodiversity including for first time maritime areas as protected land. In addition, to remark that a unique Polish Nature Conservation Act is present in Poland, whereas Spain's unified Act, but applying variable and more specific laws. Finally, we highlight the important role of Natura 2000 as in both countries it represents one of the main sources for environmental protection (talking in ha).

VII. CONCLUSION

The current work explains the biodiversity loss problem as well as the main sources of this emphasizing Nature Protection as an effective solution. Furthermore, comparison is drawn between Polish and Spanish law regarding this issue. Diverse measures are being employed nowadays in order to stop biodiversity loss such as Natura 2000 and Green Infrastructure Strategy which ensure a better management of green areas in the future. However, it should be emphasized that even the best-constructed law will not be useful if the citizens of specific countries will not accept it and apply it in their day-to-day activities. What is also needed is a deep conviction about the duties to protect biodiversity as the basis of life and development of the global human population.

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UTRATA BIORÓŻNORODNOŚCI, PRZYCZYNY, STAN I PODSTAWOWE FORMY OCHRONY PRZYRODY W HISZPANII I POLSCE

Streszczenie

Utrata bioróżnorodności to ogromny problem ostatnich lat i przewiduje się, że będzie miała nadal miejsce. Wynika to głównie z działalności człowieka. Przyczyny mogą być podzielone na bezpośrednie; takie jak użytkowanie gruntów, zanieczyszczenie środowiska lub zmiana klimatu, i pośrednie, co obejmuje czynniki demograficzne a także kwestie ekonomiczne i rządowe. W celu uniknięcia dalszego zaniku różnorodności biologicznej podejmowana jest ochrona przyrody, co odgrywa kluczową rolę w zachowaniu naturalnych ekosystemów. Celem opracowania było ukazanie problemu utraty różnorodności biologicznej oraz porównanie struktury form ochrony przyrody w Hiszpanii i Polsce.

Słowa kluczowe: utrata różnorodności biologicznej, przyczyny, stan, formy ochrony przyrody