Can Democracy save the Environment?

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Introduction

The objective of this chapter is to investigate the basic conditions and national policies that can be used to foster those local policies that promote sustainable and integral development.

The search for community (Nisbet 1953, Bauman 2008), in the second part of the 20th century and the first part of the new millennium, is increasing as a demand for greater participation and involvement of local authorities. In parallel, from the 1970s to the present, the demand for environmental and social sustainability is growing (Secchi and Gill, 2021). Among the many initiatives, the most important is the UN Agenda 2030 for Sustainable Development Goals (discussed extensively in this volume).

The demands of community and sustainability have converged in the many examples of grassroots democracy and subsidiarity. The ecomuseum movement is a good example of grassroots democracy (Eliasoph and Clément, 2020). Ecomuseums are local community projects that, by promoting the relationship between culture and the environment, stimulate the growth of ecological awareness, social cohesion and local economies (Davis, 2011). Our thesis is that democratic local community projects can raise environmental awareness and support the SDGs, but they do not operate in a political vacuum and therefore the broader political context in which they are implemented is crucial. We identified a number of significant variables that describe the general concepts of 'democracy' and 'environmental sustainability'. We tested their relationship to answer the following questions: *how do different kinds of political regimes interact with the environmental performance of different countries? Is there a linear or a more complex relationship between democracy and policies relating to environmental sustainability?* We advance some first ideas about the

impact that different aspects of a country's political regime have on environmental performance.

What is democracy?

The democracy of the ancients and that of the moderns

In this section, we do not intend to retrace the historical evolution of the concept of democracy. Our aim is merely to outline a few keywords useful in selecting specific indicators for our analysis.

The democracy of the ancients

For the ancients, *democracy* was one of the three forms of government (Aristotle book III and IV of the Politics), as distinguished by Aristotle (384 BC – 322 BC) according to the number of rulers: 'It is necessary that sovereign power be exercised by one alone, by the few or by the many' (Politics, 1279a). According to Aristotle, one must distinguish whether those who govern do so for the common good or for their own interest. Aristotle, therefore, indicates *Kingship* (exercised by one), *Aristocracy* (exercised by the few) and *Polity* (exercised by the many) as forms of government for the common good. Many years later, Polybius (200 BC ca. – 120 BC ca.) in his *Histories* (Book VI) re-evaluated the term *democracy*, defining it as the government of the many in the common interest while calling its corrupted form *ochlocracy*. Polybius also introduced the theory of *anacyclosis* (Podes, 1991), arguing that the three forms of government are weak and unstable because they can become *corrupt*.

Table 1: Types of Governments for the Ancients

	The One	The Few	The Many
For the Common Interest	Monarchy	Aristocracy	Democracy
For the Interest of the Ruler(s)	Tyranny	Oligarchy	Ochlocracy

From Middle Ages to modern political theory

The affirmation of Christianity as universal religion led to a profound rethinking of political categories, and, during the Middle Ages, religion became a powerful institution with which the state had to contend. The Church proclaimed its

spiritual supremacy over the power of the state in the name of the principle "the *imperator* was *intra ecclesiam* non *supra ecclesiam*"[1] (St. Ambrose, *Sermo Auxentium* 36).

In the 15th century, Machiavelli recognised the political supremacy of the state over spiritual power. He reduces Aristotle's tripartition to the monarchy-republic dichotomy (both can include aristocracy). Years later, Montesquieu takes up Machiavelli's biunivocal distinction, but introduces *despotism* (the exercise of absolute power) as a third category that he reserves mainly for the eastern world (Montesquieu, 1749). Throughout the 17th and 18th centuries, even before the French Revolution, economic institutions (as non-states) asserted the supremacy of the private sphere over the public one. In the 18th century, in the United Kingdom, Adam Smith (1776) theorised the inadequacy and inefficiency of state intervention in the economy and the superiority of the free market.

Parliamentary Revolution "No Bourgeoisie, No Democracy":

According to Barrington Moore (1969), after the Renaissance (called the "age of the Despots", Symonds, 2014) three democratic revolutions, activated by the bourgeoisie, created a route to *capitalistic democracy*. The first is the English Civil War and the Parliamentary Revolution (1642-1651), followed by the first industrial revolution; the second is the French Revolution (1789-1799) which disrupted the national economy and led to late industrial revolution; and the third is the American Civil War (1861-1865), followed by the industrial revolution and the abolition of slavery (December 8, 1865) which opened a new era for economic and the industrial development (Mitchell, 2015). In all these cases the farmers had no power and the bourgeoisie gained influence without encountering any real opposition from the aristocracy. We can see that while it is possible to affirm that the Parliamentary Revolution influenced the capitalistic, industrial development of the countries, the reverse is not true.

Moore also identified the conditions for the sociogenesis of fascist and communist regimes by considering the ways in which industrialisation and pre-existing agrarian regimes interacted to produce these different political outcomes. In this view, it is the behaviour of the social classes, and not that of the market, that brings about democracy. In the contemporary situation, we can indeed observe cases of industrial development without democ-

[1] The imperator is "inside" the Church, and not "above" the Church.

racy, as in the case of China and Russia. For these two countries, it is only in recent years that industrial development has led to a re-emergence of the bourgeoisie, which, however, remains closely linked to the authoritarian role of the ruling political elite.

Parliamentary democracy: party systems and voter alignments

Lipset and Rokkan (1967) attempted to reconstruct how the birth of modern political parties ran in parallel with the second industrial revolution and the construction of centralized states. They proposed the so-called theory of *cleavages* and the *freezing hypothesis*. According to the two authors, the four political cleavages were:

1. owners vs. workers (producing the formation of left and right parties)
2. nationalism vs. regionalism (producing the quest for local autonomism or secessionism)
3. State vs. Church (producing the conflict between religious and secular voters)
4. land vs. industry (producing agrarian or peasant's parties)

With the *freezing* hypothesis, Lipset and Rokkan argued that the cleavages of the 1920s continued to influence the structure of European parties until the late 1960s. It should be noted that, at least until the 1970s, green movements were not yet represented in the political arena. The diffusion of conservation organisations grew rapidly in the 1960s in response to concerns for the environment. But it was not until 1973 that The British Green Party (the first in Europe) was established.

Piketty (2020) explained why, in his view, the Lipset and Rokkan framework is no longer adequate to explain the evolution of political parties from the 1990s to the present day. Piketty's framework aims to identify four different types of electorates according to three variables: level of education, income and wealth. Depending on whether voters are for or against foreign immigration and for or against taxes to reduce inequalities, four different political groups can be identified.

Table 2: New Cleavages by Piketty (adapted from Capital and Ideology 2020).

		Migration and International Dimension (1)	
		Against (-)	Pro (+)
Reducing gap btw poor and rich Higher taxes on the wealthy (2)	Important (+)	Egalitarian Nativists (Populist Right 1)	Egalitarian Internationalists (Left?)
	Not important or dangerous (-)	Inegalitarian Nativists (Populist Right 2)	Inegalitarian Internationalists (Centre or Liberal Elitists?)

According to Piketty, in democratic (two-party or multi-party) countries, the four political families identified (particularly in France) potentially share a quarter of the electorate. However, the situation is fluid and rapidly changing. We are not interested here in delving into Piketty's framework, but merely highlight the different positions of the four electorates (as ideal types) with respect to the emergence of green demands. The positions of egalitarians and inegalitarian internationalists are generally in favour of green policies. The positions of nativists (inegalitarian or otherwise) are always against green policies. Strong inegalitarian nativist positions against the Green Deal can be found in Europe (Italy, Hungary), the United States and South America (Brazil). The most emblematic case of inegalitarian nativism is probably that of Donald Trump, who actively spoke out against environmental protection policies during his presidency.

The exogenous (independent) variables

The brief excursus allowed us to identify some keywords to proceed with the analysis of the independent variables:

1. Democracy: it literally means 'government of the people', and reflect a government system in which sovereignty is exercised directly or indirectly, by the people; in modernity it means that every citizen can freely votes to elect its representatives, and, as Moore, Lipset and Rokkan have underlined, it presupposes a multi-party system.
2. Common good: as opposed to the pursuit of the interest of a few.
3. Corruption: from the Greeks to Machiavelli till today, there is great agreement that a level of high corruption lowers the democracy level.

4. Inequality within the society. As the democracy excursus revealed (think to the French motto "liberty, equality, fraternity", or to Piketty's work), it is a crucial variable to describe a democratic country.

The following indexes have been selected to measure these aspects on a global scale.

Level of democracy (Democracy Index)

Since 2006 the EIU (Economist Intelligence Unit[2]) calculates the Democracy Index (DI). The index is based on 60 indicators, clustered in five groups/categories: *electoral process and pluralism, civil liberties, functioning of government, political participation* and *political culture*. Each year the DI measures the state of democracy in 167 countries. Each country is positioned on a scale from zero (poor) to ten (excellent) and the overall index indicates the average of the scores obtained in the five categories. In addition, each country is traced to four types of regimes, based on the average scores obtained, namely: full democracies, flawed democracies, hybrid regimes and authoritarian regimes. The percentage scores for each category are shown in Figure 1.

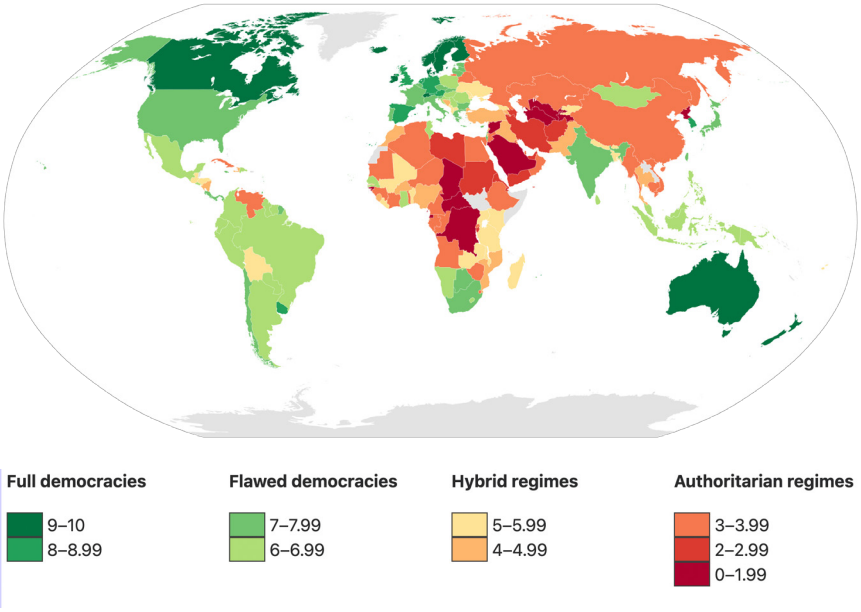

Fig. 1: map of the Democracy Index 2017, source: www.eiu.com

[2] From the influential British Economist group.

Level of pursuit of the common good (Human Development Index)

The Human Development Index (HDI)[3] (Figure 2) is the first tool created to measure the countries' wellbeing and sustainable development in a comparative way. The concept of wellbeing is focused on people, on their opportunities and choices rather than on the richness of the economy in which they live. The index is based on three dimensions and related indicators: 1. the health dimension (indicator: life expectancy at birth), 2. the education dimension (indicator: mean number of years of schooling), and 3. the standard of living dimension (indicator: gross national income per capita – GNI).

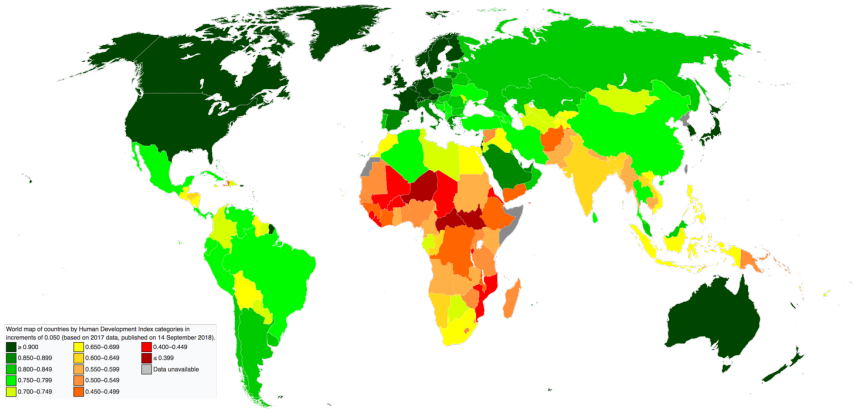

Figure 2: World map Human Development Index 2017. Source: en.population-data.net

Level of corruption (Corruption Perception Index)

The Corruption Perception Index (CPI) is a global composite index that captures the perceptions of corruption (abuse of power) in the public sector (public officials and institutions). It includes 175 countries/territories, aggregating different corruption-related data from expert and business surveys carried out by various independent and reputable institutions. The CPI is commissioned by the German association Transparency International. The CPI uses a scale from 0 (highly corrupt) to 100 (very clean), but for this analysis we reversed the scale, so that a higher value means a higher level of corruption.

[3] Information from the UNDP official website https://hdr.undp.org/data-center/human-development-index#/indicies/HDI.

We observe that the Corruption Index has a strong correlation with Gross National Income (GNI) (Pearson = -.815; sig<.001). We find that countries with lower GNI tend to receive a worse rating in the Corruption Index, compared to richer countries that are rated as less corrupt. We therefore used a statistical method to remove the impact of GNI on the Corruption Index by creating a new variable called the Revised Corruption Index (RCI). The new variable makes it possible to compare country scores without the interference of the GNI.

Level of inequality (Inequality Index)

Among the various indicators used to measure inequality, some of the best known are: 1. the Gini index, a formula that calculates the difference in a given measure (such as wealth) between pairs of individuals in a population and then sums these differences; 2. the Palma Ratio, which divides the income of the richest 10% of the population by the income of the poorest 40%.

For our analysis, we created a new Inequality Index (II) that adopts the same logic as the Palma Ratio (thus avoiding the many criticisms to which the Gini Index has been subjected, De Maio, 2007). Based on 2017 data from the World Inequality Database, the index is the ratio of the income share of the top 10% to the bottom 50% of the population of each state.

Table 3 presents descriptive data of the independent variables included in our analysis (in order: number of sample countries, mean, standard deviation, minimum and maximum value).

Table 3: The exogenous (independent) variables.

Independent variable	Year	N	Mean	SD	Min	Max
Democracy Index (EIU)	2017	151	5,53	2,19	1,13	9,81
Human Development Index (HDI)	2017	151	7,18	1,56	3,70	9,50
Revised Corruption Index (RCI)	2017	150	0,0	10,83	-31,9	35,41
Inequality Index (II)	2017	150	33,7	16,5	11	98

What is environmental sustainability?

The growing relevance of the sustainability issue

Early interest in sustainability and the disruption of ecosystem balances

The relationship between man and nature is an issue that man has been questioning for centuries, as evidenced for example in works such as De Rerum Natura, composed by Lucretius in the 1st century BC. The term 'sustainability' can be found in a 1713 text, *Sylvicultura Oeconomica*, in which the author suggested strategies for *nachhaltende Nutzung* (sustainable use) of forest resources, based on maintaining a balance between harvesting old trees and ensuring that there were enough young trees to replace them (Von Carlowitz, 1723). In the 18th century, concern about the consequences of population growth and the associated consumption of resources also began to emerge. The most famous work in this regard, "Essay on the principle of population as it affects the future improvement of society", by Malthus (1798), stated that population growth had to be limited as it threatened to outstrip food production.

The biophysical environment encompasses and supports functions essential to the lives of humans and all other living species (Daily et al., 1997), but it is possible to frame three basic activities it performs: 1) providing resources, 2) absorbing waste, and 3) providing space to live. When humans abuse the capacity of the environment to perform these three functions, environmental problems arise in the form of resource scarcity, pollution, overcrowding or overpopulation.

The topic of environmental conservation has developed mainly in the United States (Mertig, 2022) and focuses primarily on promoting responsible use of environmental resources that prevents their destruction and enables their preservation for continued use over time. A more extreme view is that of environmental conservation, according to which the environment, territories and their natural resources should not be consumed by humans and should instead be maintained in their pristine form. While the conservationist approach has a utilitarian view of the environment, in the conservationist approach the environment is endowed with an intrinsic value, which does not depend on its usefulness to man. Both approaches became particularly relevant from the end of the 19th century, when the United States promoted the establishment of national parks

and the Scotsman John Muir (1838 - 1914) founded the first and one of the most important environmental groups still active today, the Sierra Club.

The new wave of ecological consciousness

The current phase of interest in the subject thus has distant roots, but received a considerable boost in the 1960s and 1970s, in the wake of the transformations and demands that characterised Western civil society in those years. Starting from that period, in fact, awareness of the problems linked to rapid demographic growth, pollution and the depletion of natural resources spread, and social movements demanding greater respect for the environment and collective rights appeared on the political scene.

Works such as Carson's 'The Silent Spring' (1962) or Ehrlich's 'The Population Bomb' (1968) clearly expressed doubts about the limits of economic growth and the impact of society and business on the environment.

In 1972, 'The Limits to Growth' (Meadows et al., 1972), the first publication of the 'Club of Rome' group, came out, which reported the results of a study conducted by a group of researchers at the Massachusetts Institute of Technology. Using a computer modelling tool called World3, the paper presented a series of future scenarios based on the development and interactions of five factors:

- population,
- agricultural production
- depletion of non-renewable resources
- industrial production
- pollution.

The study (and its sequels) had an enormous worldwide resonance and remains to this day a milestone in the assessment of the environmental crisis. It focused on five main potentially catastrophic trends related to the progress of modern societies: 1) increasing industrialisation, 2) population growth, 3) the spread of malnutrition, 4) the depletion of non-renewable resources, and 5) the deterioration of the environment.

Using a dozen different scenarios, the researchers concluded that collapse would only be avoidable if a major change in social practices and policies and technological progress were implemented before environmental problems and resource scarcity worsened. Among the main indicators used by the model

to estimate pollution and environmental deterioration was the amount of CO2 released into the atmosphere.

Between collapse and counteraction

Planet Earth and its atmosphere are a closed system that receives energy from the sun. This energy is transformed and returned to the environment through processes that have developed over centuries, characterised by balances between the flows of energy, heat and transformation. The earth's climate is regulated by ecosystems through their action of capturing and storing carbon dioxide (CO2) (IPCC, 2006). With the advent of industrialisation, the impact of human activity has exceeded the absorption capacity of the Earth system and the balance has begun to break down, with a steady increase in hazardous emissions released into the environment. Decarbonisation, both at the level of industrial production and the activities of social life, is a fundamental step towards so-called carbon neutrality, i.e. the situation where CO2 emissions in the environment reach a level equal to its absorption capacity.

In order to coordinate countries' efforts to combat climate change and improve the overall sustainability of our world system, several international bodies have been created. The latest framework promoted by the United Nations is the Sustainable Development Goals, included in the 2030 Agenda and signed by all 193 UN members.

The endogenous (dependent) variables

There are two main aspects related to the sustainability of different countries. The first is to have laws and policies in place to preserve the environment and the second is to monitor and reduce each country's actual level of resource consumption and pollution. To assess these two aspects, the following variables were selected.

The Environmental Performance Index (EPI)

The EPI is an index that collects data from organisations, research institutes, universities and government agencies to rank 180 countries according to their performance on climate change, environmental health and ecosystem vitality, using a set of performance indicators. In 2020, the variables included in the assessment were organised into two main focuses: a) environmental health, assessed on aspects of air quality, water quality and heavy

metals, and b) ecosystem vitality, which includes indicators of Biodiversity and Habitats, Ecosystem Services, Fisheries, Climate Change, Pollutant Emissions, Agriculture and Water Resources. The EPI is geared towards assessing the performance of environmental policies implemented by countries (Wendling et al., 2020), and thus their commitment to environmental issues.

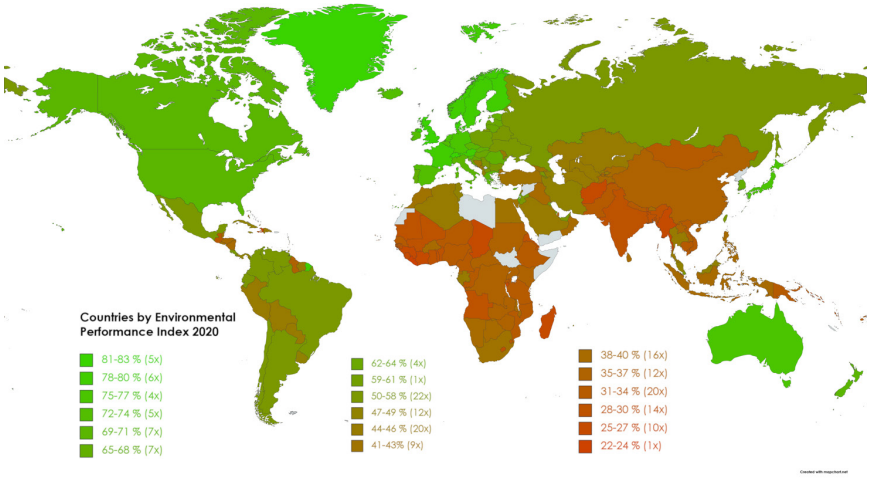

Figure 3: Environmental Performance Index 2020 world map. Source: Wikipedia.org

The Sustainable Development Goals Index (SDG Index)

The Sustainable Development Goals (SDGs) are a set of 17 global and interconnected goals designed as a "blueprint for achieving a better and more sustainable future for all" over the 2015/2030 period (see also McGhie, this volume).

In 2016, to increase the operationalisation of the goals, 169 specific targets and indicators were also identified to produce an SDG Index, the overall score that measures total progress towards achieving all 17 SDGs in each country. The score can be interpreted as a percentage of achievement of the SDGs. A score of 100 indicates that all SDGs have been achieved. The SDGs encompass aspects of economic, social and environmental sustainability and thus lie somewhere between our endogenous (dependent) and exogenous (independent) variables. For our analysis, we used the SDG Index as an endogenous variable.

Global Footprint Network - Number of Earth Required (NER)

The ecological footprint is a tool that quantifies humanity's impact on the natural environment (Wackernagel and Rees, 1998). The footprint is calculated by estimating the carrying capacity of the natural environment (both in relation to the waste generated and in relation to the environmental reabsorption capacity) and comparing it with levels of consumption and waste generation. In practice, this index encompasses the demand and supply of resources of a given territory. On the demand side, it measures the environmental resources required to make available to a given population the natural resources it consumes, the space for urban infrastructure and the space to absorb waste, in particular CO2 emissions. On the supply side, it considers the capacity of that same territory to produce the necessary ecological resources, i.e. its biocapacity. Both the ecological footprint and the biocapacity of a territory (or product) are measured in 'global hectares' (Wackernagel and Beyers, 2019). Figure 4.1 shows the difference in the ratio of consumption to carrying capacity for a selection of countries. While in Canada and Brazil (green graphs) carrying capacity exceeds consumption, due to the vastness of their natural resources, the United States and China (red graphs) use more resources than their biocapacity can support.

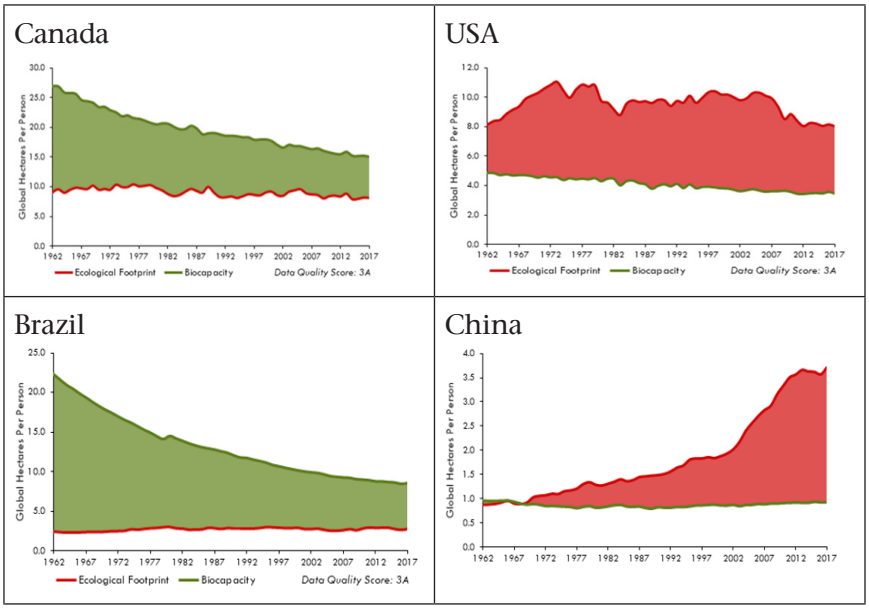

Fig.4: Ratio between Ecological Footprint and Biocapacity of some Western countries. Source: data.footprintnetwork.org

Among the various indicators that the Global Footprint Network makes available on its website, we have selected the "Number of Earths Needed" for our analysis. This indicator calculates the ratio of each nation's per capita Ecological Footprint to global per capita capacity, allowing us to estimate how much Land would be needed if the world's population lived by that specific nation's standards. This indicator allows us to see which country is consuming the most resources, in absolute terms. From this perspective, Canada's behaviour is highly unsustainable, as 5.1 Lands would be needed to sustain a world population living by Canadian standards, which is the same number of Lands needed if everyone lived like the inhabitants of the United States. This is because the residents of both countries have a resource-intensive lifestyle. On the other hand, if everyone lived like a resident of China, 2.4 Earths would be needed and even less if everyone lived like a resident of Brazil, with only 1.6 Earths ("National Footprint and Biocapacity Accounts", 2022). This indicator was chosen to assess actual consumption and pollution, adopting a global framework.

CO_2 emission

According to the latest data (2019) from the Climate Watch platform[4], about 60% of the global greenhouse gas emissions comes from just 10 countries in the world (first and second are China and USA) while the 100 least emitting contributed less than 3%. The estimation of carbon emissions on a national scale can be describe as the physical measurement and non-economic evaluation of greenhouse gas emissions caused not only directly and indirectly by human beings in a nation or smaller area, but also by natural events. For this analysis, we used the 2017 CO_2 emission (metric tons per capita form) data from the Climatewatchdata.org platform.

PM2.5

Particulate matter (PM) refers to all solid and liquid atmospheric particles suspended in ambient air. The term PM2.5 identifies particles with a diameter less than or equal to 2.5 μm (more than 100 times finer than a human hair). PM 2.5 is also called 'fine particulate matter', a name that contrasts with 'coarse particulate matter' (PM 10), which denotes all suspended particles with a diameter between 2.5 and 10 μm. PM 2.5 is

[4] https://www.climatewatchdata.org/.

generated by all types of combustion, including those from car and motorbike engines, power plants, wood for domestic heating, forest fires and many other industrial processes. Like PM 10, these particles are characterised by long residence times in the atmosphere and, compared to coarse particles, are able to penetrate deeper into the human respiratory system, reaching the lungs and bloodstream and thus posing an important health risk.

Since 31 December 2016, the EU Directive on the reduction of national emissions of certain pollutants (2016/2284) (abbreviated as: NEC Directive) has been in force. In Europe, from 2020, annual average values of PM 2.5 must not exceed 20 μg/m3 (E.U., 2016), although, according to the latest WHO air quality guidelines, small particulate matter pollution has an impact on health even at very low concentrations and no threshold has been identified below which no health damage is observed (World Health Organisation, 2021).

For this analysis, we used the 2017 Exposure data of PM 2.5 micro gr per year from the World Bank dataset.

Table 4 presents the descriptive data (mean, standard deviation, minimum and maximum value) of the dependent variables included in our analysis for the entire sample of countries.

Table 4: The endogenous (dependent) variables

Dependent variables	Year	N	Mean	SD	Min	Max
Environment Performance Index (EPI)	2017	151	47,83	16,02	22,6	82,5
Sustainable Development Goal (SDG Index)	2017	149	67,61	9,90	38,5	84,7
Number of Earths Required (NER)	2017	149	2,04	1,51	0,4	9,2
CO 2 Tons per capita (CO_2)	2017	151	4,37	4,94	0,04	32,13
PM 2.5 Exposition micro gr per year (PM 2.5)	2017	151	28,49	19,87	5,86	99,73

Discussion

The relation between our endogenous (dependent) and exogenous (independent) variables was tested to assess the impact

that different aspects of a country's governance have on its environmental performances. We used the statistical regression method for our analysis. This method allows to predict the behaviour of the dependent variable based on the values of the independent(s) variables. The R^2 coefficient indicates what proportion of the total variance of the independent variable can be explained and goes from 0% (no variance explained) to 100% (we can perfectly predict the values of the dependent variable based on the values of the independent variables)[5].

We included in our analysis the 151 countries that had available data for all the variables of interest.

The results of our analysis are resumed in table 5 and detailed in the following lines.

Good practices and environmental policies 1 (dependent variable: EPI)

The environmental performance of a country, that describes the kind of policy and actions promoted to support environmental sustainability, is significantly explained by its human development (HDI) and level of democracy (DI): higher values on both variables predict a better environmental performance for the country (as shown by the positive B value in table 5). The Revised Corruption Index and the Inequality Index don't have explanatory power and, overall, the model explain 66% of the variance of our dependent variable (R^2 = 0,660; sig <,001).

The significance of the impact increases in the second model (R2 = 0.777; sig <.001), when countries falling under the authoritarian form of government are removed from the sample. The increase from 66% of the variance explained to 77% in the second model can be understood by looking at Figure 5: the variance among authoritarian countries (blue dots) is very high, with some relevant outliers, such as Zimbabwe and the United Arab Emirates, while the hybrid regime, imperfect democracy and full democracy groups have a more homogeneous perfor-

[5] For example, we can use an equation of linear regression to estimate a person's weight based on sex and height: if we know the sex and how tall that person is, we can calculate the wight with a certain level of approximation. If the result is statistically significant, that means it's unlikely to be explained solely by chance or random factors. In other words, a statistically significant result has a very low chance of occurring if there were no true effect in a research study. Generally, a statistical significance (sig.) of 0.05 or lower is considered acceptable. The bootstrap method (Efron, 1982) was used for the hypothesis testing. Bootstrap is a computer-based method that consist in re-sampling a great number of sub-samples to verify the reliability of the selected models.

mance in terms of EPI. Excluding authoritarian countries from the analysis increases the explanatory power of the model, because the performance of authoritarian countries is less predictable and can be assimilated to the behavour of outlier[6] cases.

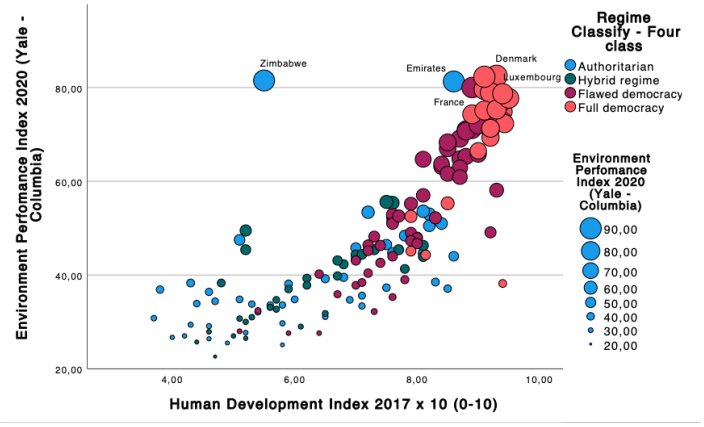

Fig. 5: Scatter plot of Environmental Performance Index in contrast to Human Development Index by Regime

Good practices and environmental policies 2 (dependent variable: SDG Index)

The model built to predict performance in the SDG Index performs best. The independent variables assessing the level of human development, perceived corruption and inequality of countries explain much of the variance in countries' SDG performance. As mentioned above, the assessment of the SDGs, similar to the EPI, is based on the assessment of countries' policies and strategies.

The variance explained by the regression is very high (R2 = 0.877; sig <.001), and Table 5 shows that a higher level of human development (HDI) allows one to predict higher values of the SDG index. In contrast, higher values of corruption (RCI) or inequality (II) predict lower performance in the SDG index.

As expected, the results of the EPI and SDG model show some similarity (high level of explained variance, positive impact of the HDI and negative impact of the II), as both variables focus on policies and laws implemented by countries to promote sustainability.

[6] An outlier is an observation that lies outside the overall pattern of a distribution (Moore and McCabe 1999), a data point that differs significantly from other observations. Outliers can be indicative of the fact that, in a given sample, some data belong to a different population than the rest of the sample and may be discharged from the analysis.

Use of natural resources (dependent variable: NER)

The variance explained for the Required Earth Number model is 54% (R2 = 0.545; sig <.001), and the independent variables with explanatory power are HDI and RCI. As shown in Table 5, both independent variables have positive B-values, meaning that a higher level of human development and a higher level of corruption predict a higher level of NER.

Excluding authoritarian countries, the explained variance rises to 60 per cent (R2 = 0.600; sig <.001), and while the NER is no longer significant, the B-value in Table 5 indicates a higher level of human development and democracy. Similar to the EPI model, we can see in Figure 6 how authoritarian countries (blue dots) can have very high and very low levels of resource consumption, and the same happens with their HDI values. In the other groups of countries, the differences between high and low performance are less pronounced.

On the other hand, this regression clearly shows that countries with a high level of human development are, in many cases, also strong resource consumers (and polluters, as we will see in the next two models), due to the standard of living of their citizens.

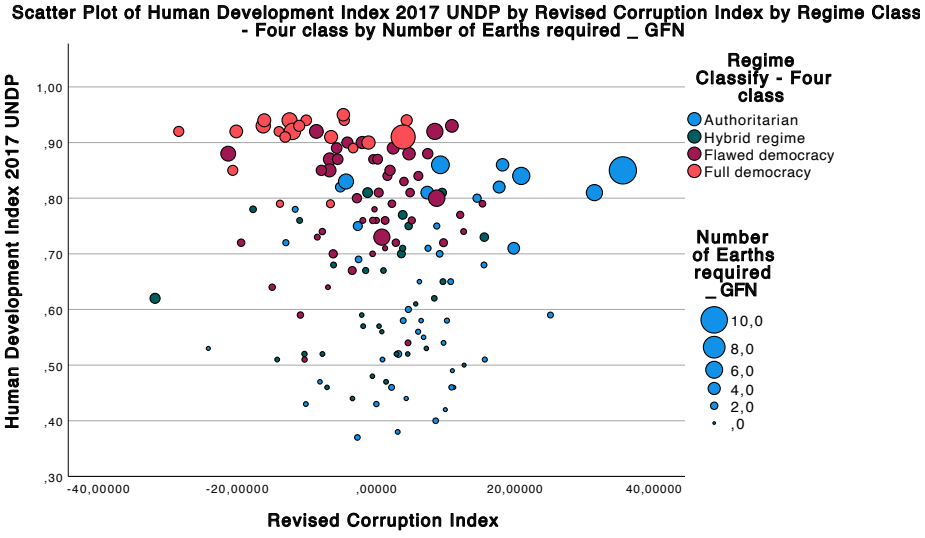

Fig. 6: Scatter plot of Human Development Index in contrast to Revised Corruption Index by Regime and Number of Earth Required

Level of air pollution 1 (dependent variable: CO_2)

The explanatory power of the independent variables for the level of CO2 emissions of each country is lower than that of the previous models (R2 = 0.523; sig <.001) and even the exclusion of authoritarian countries leads to only a slight improvement (R2 = 0.533; sig <.001).

The first model, which explains 52% of the variance, includes all countries in our sample and is therefore considered more satisfactory. Table 5 shows that higher levels of democracy (DI) lead to lower CO2 emissions, while higher levels of human development (HDI) and corruption (RCI) predict higher CO2 emissions. This result is in line with those of the NER model, as, once again, we see how human development leads to higher resource utilisation.

Level of air pollution 2 (dependent variable: PM 2.5)

As introduced, the variable PM 2.5 assesses a more specific aspect of sustainability, namely the exposure of the human population to toxic particles produced by combustion. In this case, the explanatory power of the variables so far included in our model is only moderate (R2 = 0.333; sig <.001), which means that other aspects have a significant impact on its distribution. However, Table 5 shows that a higher level of democracy (DI) predicts lower PM 2.5 emissions.

The exclusion of authoritarian countries from the model leads to a substantially equal explained variance (R2 = 0.332; sig <.001), but allows us to highlight, alongside the level of democracy, the similar role played by the level of human development, meaning that higher levels of democracy and human development predict lower levels of PM 2.5.

*Table 5: Selected regression models results. ** level of significance < of .001*

			Indipendent variables B value				R^2
		costant<7>	DI	HDI	RCI	II	
Dependent variable							
EPI	All included	-9,339	1,521	6,791	--	--	,660**
	No authoritarians	-15,868	2,491	7,246	--	-,142	,777**
SDG Index	All included	32,360	--	5,309	-,127	-,090	,877**
	No authoritarians	--	--	--	--	--	--
NER	All included	-3,125	--	,720	,023	--	,545**
	No authoritarians	-3,636	,227	,565	--	--	,600**
CO_2	All included	-11,299	-,430	2,510	,114	--	,523**
	No authoritarians	-10,763	--	1,980	--	--	,533**
PM 2.5	All included	57,447	-5,245	--	--	--	,333**
	No authoritarians	71,516	-3,417	-3,446	--	--	,332**

Conclusions

Our analyses illustrate a complex relationship between different aspects of democracy and environmental performance measured at the country level. The most policy-focused indices, namely the Environmental Performance Index (EPI) and the Sustainable Development Goals (SDG) Index, show a positive correlation with countries' level of democracy and human development. This means that democratic practices favour environmental performance. On the other hand, a higher level of human development is associated with higher levels of resource consumption and pollution. Since human development and democracy are strongly correlated, the most democratic countries are often also the most environmentally impactful.

The most democratic and developed countries have historically had a large impact on the environment, but they are moving in the direction of greater sustainability. They seem to have assumed that certain forms of democratic practices, rooted at the local level (e.g. ecomuseums), are fundamental to achieving local and global development goals.

Countries with authoritarian regimes perform very differently, moving from one extreme to the other on the scale of values taken into account. In some cases, 'enlightened' despots seem particularly sensitive to the environment, in other cases the level of environmental protection is very low, while consumption and pollution levels are high.

An ecological consciousness is also developing in authoritarian countries, but understanding their specific dynamics requires more in-depth study. The natural evolution of this reflection leads us to point out the need for a global data collection, a census of ecomuseums and the actions they develop in relation to sustainability and climate change.

Such data would make it possible to investigate the real and potential impact, on a global scale, that state policies can have in favouring virtuous local practices of sustainable development.

On the other hand, since the ecomuseum model of direct and participatory democracy is also spreading in so-called authoritarian countries (see, for example, among many: Colasanti and Frondizi: 2018, Inokoba and Kalagbor: 2021, Kennedy, Liu and Nagao: 2018, Tong and He: 2018, Borrelli and Ge, 2019) an in-depth study could investigate whether, in authoritarian countries, the ecomuseum participatory model and that of grassroots democracy can foster the transition towards less authoritarian forms of government.

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DICHIARAZIONE SOSTITUTIVA DI CERTIFICAZIONE e/o di NOTORIETA'
ai sensi degli artt. 46 e 47 del D.P.R. n. 445 del 28 dicembre 2000

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D I C H I A R A N O

di essere coautori dell'articolo dal titolo Marra, E., Mura, G., Bernardi, M. (2023). *Can Democracy save the Environment?*. In N. Borrelli, P. Davis, R. Dal Santo (a cura di), Ecomuseum and climate change (pp. 153-176). Ledizioni. ISBN: 9788855268387

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