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THE RULE IN RYLAND v FLETCHER AS A PANACEA FOR THE CONTROL OF ENVIRONMENTAL POLLUTION

Dr. Richard Gershon CHINDA*
Innocent Justice ODUM**

ABSTRACT

The landmark English tort law case Rylands v. Fletcher established the doctrine of strict liability for inherently dangerous activities. The case arose when Fletcher's coal mine was flooded due to Rylands building a reservoir on his land, which burst and caused damage. The court ruled that a person who, for their own purposes, brings and collects something likely to do mischief if it escapes, must keep it at their peril. If they fail, they are strictly liable for any resulting damage. This doctrine laid the foundation for modern environmental and nuisance law, emphasizing the responsibility of individuals to contain potential hazards they introduce. Situations like this has plagued Nigeria for long and indeed the entire world, as it has nocuous and deleterious effects to human life, fauna, flora, land, the ecosystem and the economy on the long run. Apparently, The Rule in Ryland v Fletcher as a Panacea for the Control of Environmental Pollution" the Niger Delta Region for more than four decades of exploration and production operations, has experienced severe environmental degradation and pollution and Oil spill and Gas flaring has been identified as the major sources of environmental pollution in the region. For many years, the Nigerian Government has laid emphasis on the need for exploitation of oil and other natural resources for developmental purposes without making adequate provisions for the negative impact of this exploration activities on the environment. The Rule in Ryland v Fletcher is one of the principles of common law, which is to the effect that, a person who for his own purpose brings on his land, collects and keeps there anything likely to do mischief, keeps it at his own peril if it escapes and causes harm to another person, is prima facie answerable to all the likely damages which is the natural consequences of its escape. The devastating effects of environmental pollution on the environment which include water, land and air in Nigeria is not novel, the pollution posed, ranges from biological damage, physiological (pathological) effect on the biota (plant and animals) to abroad range of ecological changes, hence the need for the control of environmental pollution arises. The application of the rule has proved very effective in the fight and control of environmental pollution in Nigeria. The study adopted a doctrinal approach is reviewing extant regulations, cases, previous studies and other relevant literature. *The researcher found out that application of the rule in Nigeria is strictly construed. It also found out that in some other jurisdiction like India and Canada the rule is applied beyond environmental pollution, and that it was also applied in cases of road accident. The researcher also found out that, there is need for further study on the expanse of the scope of the application of the rule in Nigeria. Conclusively, the researcher recommended that in other to control environmental pollution in Nigeria, Nigerian government must demonstrate sincerity of purpose and a clear political will towards strengthening and implementing the environmental regulatory framework in the industries. The judicial arm of the government should be strengthened the more in order to prevent interference from external sources to pervert justice or giving decision that will not affect those persons involved in environmental pollution.*

Keywords: Pollution, Environment, Panacea , Control.

INTRODUCTION

The case of *Rylands v Fletcher* represents a pivotal moment in the development of English tort law, marking the emergence of the principle of strict liability. This landmark decision

*Dip Law, LLB, BL, LLM, PhD, Lecturer 1, Commercial and Industrial Law Department, Faculty of Law, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt. Phone: +234(0)8036759338; Email: richard.chinda@ust.edu.ng.
**LLB, LLM, Faculty of Law, Rivers State University, Port Harcourt, Nigeria

established that a person who brings onto their land anything likely to cause harm if it escapes, is liable for any damage that ensues, even in the absence of negligence. The case arose when the defendant, Rylands, constructed a reservoir that subsequently burst, causing flooding to the plaintiff Fletcher's coal mine. The ruling by the House of Lords introduced a new dimension to liability, separating it from fault-based doctrines and focusing instead on the inherent risks associated with hazardous activities. Over time, the Rylands principle has influenced environmental law, land use policy, and has been subject to significant judicial interpretation and limitation. This research examines the origins, legal reasoning, and evolving significance of the Rylands v. Fletcher doctrine within common law jurisdictions.

The NESREA Act[1] defines pollution as any man made or man aided alteration of chemical or biological quality of the environment to the extent that it is detrimental to the environment. Nigeria has witnessed several incidents of pollution in its environment emanating from gas flaring, oil spillage, and in ordinate toxic waste disposal (including non-biodegradable waste), inconsiderably loud noises from religious and social gatherings, etcetera. Hence, the need to protect and control environmental pollution.

The first attempt in Nigeria to protect her environment dates back to 1904 according to Okonkwo.[2] He posits that this started with the passing of the Cantonment Proclamation of 1904 on the layout and sanitation of G.R.A, followed by the Public Health Act of 1909, Minerals Oil Ordinance of 1916, the Criminal Ordinance of 1916[3]- which provides sanctions for offences against public health, Petroleum (Drilling and Production) Regulation Act of 1969,[4] etcetera. Notwithstanding all these legislative efforts, none existed which was properly suited to actually and effectively address the issue of environmental pollution in Nigeria. In other words, there was no effective mechanism deliberately put in place by the government of Nigeria to address the issue of environmental pollution. This was the state of things until the unfortunate but eye-opening event of 19th September, 1987, where a farmer named Chief Oyemiren Nana, from Koko, Delta State, in collaboration with an Italian businessman named Gian Franco Raffaeli dumped about 3,880 tons of toxic and hazardous waste at Koko in Warri, Delta State on behalf of an Italian company. The incident took the Nigerian government by surprise as there was, as

[1] National Environmental Standards and Regulations Enforcement Agency (Establishment) Act No_25, 2007.
[2] T Okonkwo, Environemntal Constitutionalism in Nigeria, (2015) Vol. 13 Nigerian Juridical Review 175.
[3] Now Ss 243-248 Criminal Code Act Cap C38 Laws of Federation of Nigeria 2004.
[4] Cap P10 LFN, 2004.

earlier stated, no appropriate legal mechanism to deal with such incident. As a result, on the 30th day of November, 1988, the federal government of Nigeria moved to enact the Harmful Waste (Special Criminal Provisions, etc.) Act.[5] This Act marked the first conscious attempt of Nigeria to create a legal regime that sought to address squarely the issue of environmental pollution. After this, other laws followed suit, with the creation of agencies and institutions manned to protect and control environmental Pollution. Another significant incident of environmental pollution in Nigeria is the Niger-Delta situation.

The region suffers several incidents of oil spillages, gas flaring and other oil and gas related pollution. The over four decades of oil exploration and mining has subjected the peoples of that region to the status of endangered species in all spheres. Oil spillages on its own, destroys the integrity of their soil and waters, inhibiting agrarian practices in the area geographically known for its robust cultural and agricultural practices. While flared gas continuously take huge tolls on the general health of living things in the area, not excluding human beings. Little wonder this prompted the exemplary and selfless struggle of the Late Ken Saro-Wiwa against the multi- national oil companies, putting his life at stake, in order to assuage the plight of the Niger-Delta and stop further pollution of the region. Ali,[6] while addressing an audience in an international seminar on oil pollution in Nigeria, has this to say- "As a result of oil losses, vast tracts of agricultural lands have been laid waste, thus, becoming unproductive, surface water are polluted rendering the water undrinkable and the aquatic life is destroyed.

The result is great hardship for the inhabitants who become impoverished and deprived. These unfortunate citizens are therefore compelled to emigrate to other towns and villages in search of a decent life" to establishing the basic institutional machinery for environmental management in Nigeria. Consequently, amended by Decree number 59 of 1992, the FEPA Act[7] was established for the protection and development of the environment, bio-diversity conservation and sustainable development of Nigeria's natural resources. The decree also

[5] Cap H1 LFN, 2004.
[6] Ali Ambros's Ceremonial Opening address in an International Seminar on the Petroleum Industry and the Nigerian Environment held in Port Harcourt in 1981 at page 4 – as cited by Charity Ifeyinwa Obidiwe – 'Oil Spillages and the Nigerian Environment: An Appraisal' (2010), *Nigerian Environmental Law Teacher's Society*, Vol. No. 2 (Kingdom Age Publishers for Nigerian Environmental Law Teacher's Society) 47.
[7] Cap F10 Laws of Federation of Nigeria 2004.

charged the FEPA with responsibility of implementing the Harmful Waste Act;[8] making regulations generally for its purpose; and prescribing standards for noise control, control of hazardous substances and removal control methods, Atmospheric protection, influent limitations, water quality, and air quality. By 1999 the Federal Ministry of Environment was created and it took over the functions of Federal Environmental Protection Agency. Then in 2007 the National Environmental Standard Regulation Enforcement Agency Act (NESREA)[9] was passed into law and by virtue of its section 36, it repealed the Federal Environmental Protection Agency (establishment) Act.[10] Other laws enacted for the protection of the environment in Nigeria include the following; Oil in Navigable Waters Act,[11] Environmental Impact Assessment (EIA) Act,[12] Nigerian Urban And Regional Planning Act,[13] Hydrocarbon Oil Refinery Act,[14] Associated Gas Re-injection Act,[15] Endangered Species Act,[16] Exclusive Economic Zone Act,[17] Niger-Delta Development Commission Act,[18] Animal Diseases (Control) Act,[19] Quarantine Act,[20] Nuclear Safety and Radiation Protection Act,[21] Territorial Waters Act,[22] amongst others. However, despite the existence of these laws, there is no comprehensive statutory enactment for adequate compensation of victims of pollution in Nigeria. Bearing in mind that no law is devoid of lacunas and deficiencies of its own, most of these laws merely provide punitive measures against defaulters, and do not provide proper succour for pollution victims. As earlier stated, the effects of pollution touch on both the health and wealth of the environment affected. Hence, the need for adequate solutions to the issue. The common law Rule in *Ryland v Fletcher* (Strict Liability) therefore, stands a better chance in protecting and controlling environmental Pollution in Nigeria than our extant laws.

[8] Harmful Waste (Special Criminal Provision, etc.) Act 1988.
[9] National Environmental Standards and Regulations Enforcement Agency (Establishment) Act No. 25, 2007.
[10] EPEA, Cap F10, LFN 2004.
[11] ONWA, Cap O6, LFN 2004.
[12] EIAA, Cap E12 LFN, 2004.
[13] NURPA, Cap N138 LFN, 2004 s 39(7).
[14] HORA, Cap H5 LFNigeria, 2004.
[15] AGRA, Cap 20 LFN, 2004
[16] ESA, Cap E9 LFN, 2004.
[17] EEZA,Cap E11 LFN, 2004.
[18] NDDCA, Cap N68 LFN, 2004.
[19] ADA, Cap A93 LFN, 2004.
[20] QA, Cap Q2 LFN, 2004.
[21] NURPA, Cap N142 LFN, 2004.
[22] TWA, Cap T5 LFN, 2004.

THE CASE OF RYLAND v FLETCHER

In 1860, Thomas Fletcher, the defendant appellant, and a mill owner, engaged some independent contractors to build a water reservoir on his landed property in order to supply water to his mill (The Ainsworth Mill). Fletcher was passive in the construction of the reservoir as the contractors took care of everything. During the said construction, the contractors discovered disused mine shafts and passages under the land filled loosely with soil and debris, which unbeknownst to them connected to Ryland, the plaintiff-respondent's coal mine located on an adjoining land. The contractors did not block the shaft upon discovery. Shortly afterwards, the reservoir having been filled with water burst and flooded Ryland's coalmine on his land, damaging it. The Plaintiff sued, and the court awarded a cost of 937 (Nine hundred and thirty-seven) Pounds worth of damages in favour of the plaintiff against the defendants. The defendant's conduct did not appear to come within the scope of any existing tort; they were not liable for trespass, because the damage was not direct and immediate; nor for nuisance, because the damage was not due to any recurrent condition or state of affairs on their land; nor negligence, because they had not been careless, and they were not liable for the negligence of their independent contractors.[23] However, they were held strictly liable for the damage on the basis of the following rule propounded by Blackburn J, which is now known as the rule in *Ryland v Fletcher.* In the words of **Blackburn J,**

> any person "who for his own purposes brings on his lands and collects and keeps there anything likely to do mischiefifit escapes, must keep it in a this peril, and, if he does not do so, is prima facie answerable for all the damage which is the natural consequences of its escape."

On appeal, the House of Lords (Per Lord Cairns) held the defendants liable because he has made a non-natural use of his land.[24] The rule as stated by Blackburn J., is said to be of absolute liability. It has also been applied to variety of things like fire, gas explosion, electricity, oil noxious fumes, rusty wire from a decayed fence, vibrations etcetera.[25] To succeed under the rule in Ryland v Fletcher, the following requirements must be satisfied to wit:

[23] The Case was decided before the emergence of the principle that an employer may be held liable for negligence of his independent contractor while where ultra-hazardous activities are involved.
[24] (1866) LR IE x 265279 – 280.
[25] *Read v Lyons* (1947) AC156 at 168.

a) The defendant must have brought, accumulated or kept something which is likely to do mischief (something which is potentially dangerous) if it escapes.
b) There must be a non-natural user of land.
c) The defendant must have control over the land or must be an occupier or owner of the land from which the escape took place.
d) There must be an escape from the defendant's land to another place which is not with in his control[26].

It is worthy of note that the plaintiff must prove all the requirements listed above to succeed in a claim for damages under the rule in *Ryland v Fletcher*.[27]

The Scope of the Rule in *Ryland v Fletcher*

At the English Court of Exchequer, the rule in *Ryland v Fletcher*[28] states thus, per Blackburn J.; We think that the true rule of law is, that the person who for his own purposes brings on his land and collects and keeps there anything likely to domischief fit escapes, must keep it in a this peril, and if he does not do so, is prima facie answerable for all the damage which is the natural consequence of its escape. by its nature, the rule imposes strict liability on anyone who brings anything likely to cause harm or damage to another, on his property, which said thing does eventually causes harm or damage to another. It is apt and apposite to briefly examine the tort concept of strict liability, which is the principle of law the rule expounds. Strict Liability on the other hand simply means liability without fault.[29] According to Malemi[30]

> it is the liability that attaches to a person once a wrong occurs, without actual negligence, or intention on his part, because there has been a breach of an absolute duty not to do the thing that is prohibited.

It therefore means that the *mens rea* of the defaulter is not put into contemplation in the determination of who is liable in this context. Such is the tort law principle of strict liability as expounded in *Ryland*'s case. This is visible according to the facts, where Mr. Fletcher was held

[26]*Ryland v Fletcher* (1866) LRIE x 265279-280.
[27]Ibid 280.
[28] (1866) LRI Exch 265 at 279-280; *Tenant v. Goldwyn* (1704) 91 ER20.
[29] EO Malemi, *Law of Tort* (2nd edn; Lagos: Princeton Publication Co 2013) 491.
[30]Ibid, 491.

liable for an act which was not directly his fault but that of a negligent third party contracted by him to work on his behalf, and also based on the fact that he had instructed the introduction of a non-natural thing, which later caused damage, to be place on his land. Blackburn J, in an attempt to further expatiate on the scope of the rule, opined:

> The general rule, as above stated, seems just. The person whose grass or corn is eaten down by the escaping cattle of his neighbour, or whose cellar is invaded by the filth of his neighbour's privy, or whose habitation is made unhealthy by the fumes and noise-some vapours of his neighour's alkali works, is damnified without any fault of his own; and it seems reasonable and just that the neighbour, who has brought something on his own property which was not naturally there, harmless to others so long as it is confined to his own property, but which he knows to be mischievous if it gets on his neighbour's should be obliged to make good the damage which ensues if he does not succeed in confining it to his own property. But for his own act in bringing it there, no mischief could have accrued, and it seems just that he should at his peril keep it there so that no mischief may accrue, or answer for the natural and anticipated consequences. And upon authority, this we think is established to be the law whether the things so brought be beasts, or water or filth or stenches.[31]

The Elements of the Rule in *Ryland v Fletcher*

a. That the defendant introduced a non-natural thing (user) on his land.

b. The escape of the thing.

c. That the natural consequence of such escape is damage.

d. That the plaintiff suffered damage as a result of such escape.

a) That the defendant introduced anon-natural thing (user) on his land.

The issue of non-natural user seems to be a question of facts and not of law. Lord Moulton in *Rickard sv. Lothian*[32]defines it as:

> It must be some special use bringing with its increased danger to others and must not merely be the ordinary use of the land or such a use as proper for the general benefit of the community.

[31] (1866) LR1 Exch 265 at 280.
[32] (1913) AC 263 at 279 – 280.

THE RULE AS PANACEA FOR CONTROL OF ENVIRONMENTAL POLLUTION

By the peculiar nature of recent environmental degradation incidents, other tort law principles like nuisance, trespass and negligence would not suffice inputting as top to it. Likewise, our domestic statutes, which as above stated, is fraught with many problems plaguing its effective application. The major reason why other tort laws may tend not to be totally effective is because of the requirement of 'intention' or 'fault' on the side of the defendant/defaulter in order to be established in court.[33] This is not usually the case with current (and even past) trends of pollution cases, as most of the defaulters do not intentionally set out to cause these degradations, neither are the incidences any fault of theirs.[34] The rule simply means liability without fault, as it is the liability that attaches to a person once a wrong occurs, without actual negligence, or intention on his part.[35] Hence, it is not necessary to prove negligence on the part of the person allowing the damaging material to escape, once it has been shown that the use is "non-natural" and that the material is dangerous or "mischievous." In the case of *SanIkpede v. Shell–BP Petroleum Development Company Nigeria Limited*[36]the plaintiffs claimed damages as a result of the escape of crude oil and from oil pipelines of the defendant onto the land of the plaintiffs. It was held PerOvie–Whiskey, J. (as he then was) that 'to lay crude oil carrying pipes through swamp forest land is a non-natural user of the land' and that 'it is common knowledge that crude oil causes great havoc to fishes and crops if allowed to escape from the pipeline in which it is being carried.'[37]

APPLICATION OF THE RULE IN *RYLAND V FLETCHER* IN NIGERIA

Over the years and since the introduction of the Common law Rule in *Ryland v Fletcher* into Nigeria, the rule has significantly developed. This development can be greatly attributed to the industrial boom, especially in the Oil industry, which the country has been made privileged to witness within its shores. Another is the attitude of persons towards the Courts. Nigerians are more aware now than they were about the merits of resolving their grievances through the

[33] E Malemi, *Law of Tort in Nigeria* (Lagos: Princeton Publishing Co. 2007) 480.
[34]Ibid, 480.
[35]Ibid, 491.
[36] (1973) MWSJ 61.
[37]*Shell PetroleumDevelopment Company of Nigeria. Chief Tigbara Edamkue & Ors* (2009) 10 SCM 150 at 151 and 152.

appropriate channels, being the Courts. Some judicial activism, courtesy of some of our erudite Judicial Officers, is another thing worth commending. This is so because they have made it possible to seek redress in seemingly novel areas of the law, sampling intriguing and ground breaking arguments. These, amongst others, have influenced the application of the rule in *Ryland v Fletcher* in Nigeria. The Supreme Court applied the rule in *Ryland v Fletcher* in the case of *Machine Umudje v. Shell B.P Petroleum Development Co. Ltd.*,[38] the defendant company diverted a natural flowing lakes and ponds in the course of its exploration of oil, this denying the plaintiff of water and fish. Oil waste also accumulated by the defendant company escaped into and caused damage to the plaintiff's land hence the suit. According to the Supreme Court the defendant company was liable under the rule in Ryland's case because the crude oil was collected and kept in a pit under the occupation and control of the defendants escaped onto the adjoining land of the plaintiff where it caused damage. Thus, the court held that the defendant company was liable for the escape of the crude oil waste that caused damage to the plaintiff's land, and killed fishes therein. Hence holding them liable in damages to the damages caused the lakes and ponds. Nevertheless, the court went forward to hold that the defendant company was not liable for diverting the course of the natural stream, as there has been no flooding of the plaintiff's land, but only a denial of the plaintiff of access to fish and water.

APPLICATION OF THE RULE IN CANADA

Canada, another commonwealth country having been colonized has adopted the common law rule in *Ryland v Fletcher* in controlling environmental pollution. In *Scythes & Co. Ltd. v. Gibson's Ltd.*,[39]the facts of the case, according to the records of the Supreme Court of Canada (2007), has it that the defendant, a leaseholder of building, rented some parts of the premises of its building to the plaintiff. There was a pipe that carried water for fire protection from the city's system through the building, within said rented premises. The pipe which happened to pass through the plaintiff's premises burst and the plaintiff's goods were damaged as a result. Hence the suit. Relying on Strict liability, the plaintiff sued for damages, arguing that the defendant failed to take precautions by turning off the water and draining the pipe during the cold weather. The Court held that the defendant was not liable. From the Court's ruling it can

[38] (1975) 11 SC (Pt 155) 10.
[39] (1972) SCR 352.

be distilled that the rule *Ryland and Fletcher* did not apply, either in general or with any modifications, because both the plaintiff and the defendant shared the same land and the escape of the water did not cause damage to a person from another land.

FACTORS MILITATING AGAINST THE APPLICATION OF THE RULE IN *RYLAND v FLETCHER*

The rule like any other legal principle is subject to determination of the Court when a cause of action arises. Hence subject to litigation. Litigation is therefore a means through which victims seek redress from the Court for acts violating their person, property or rights generally. Thus, the problem associated with the application of the rule is the common problem associated with any typical litigations in Nigeria.[40] First on the list is the ever plaguing problem of Nigeria, 'Corruption'. Corruption is said to have crept into every section of the Nigerian society, and the judiciary seems not exempted.[41] Corruption is aptly defined by Igwenyi[42] as a negative attitude or tendency in man's behaviour which enables him to use his privileged position either in public or private to corner some undeserved benefits for himself or his cronies to the detriment of other members of the society. The benefit could be cash, material or immaterial or even outright privileges or goodwill.[43]

Courts are often said to be the last hope of the common man, however this hope has since been eroded as the common man can no longer totally rely on the integrity of the courts nowadays. Second is the issue of delay in the prosecution of cases. This particular problem is multifaceted as it can be attributed to several causes. It has eroded public confidence in the judicial process as most litigants now opt for settlement out of court, or simply ignore any infringement on their rights.[44] Delay in prosecution of cases has the counter-productive effect of discouraging litigants either in pecuniary terms or otherwise, from pursuing a cause of action, thus frustrating any attempt to seek redress. The case of *Nwadiaro v. Shell Petroleum Development Co. Ltd,*[45]is a quintessential depiction of this menace. The facts of the case has it

[40] E O Nwosu, Petroleum Legislation and Enforcement Laws and Standards in Nigeria (1998-99) *Nigerian Judicial Review* 99.
[41]Ibid.
[42] Benjamin O. Igwenyi, *The Crime of Corruption in Nigeria: Laws, Issues and Solutions* (Enugu, SNAAP Press Ltd 2010) 5.
[43]Ibid.
[44] Benjamin O. Igwenyi, *The Crime of Corruption in Nigeria: Laws, Issues and Solutions* (Enugu, SNAAPP Press Ltd 2010) 6.
[45] (1990) 5 NWLR (Pt 150) 322.

that the plaintiff depends on a particular creek for fishing and access to same was blocked by the defendant since 1966. The parties spoke a negotiated term of compensation and the defendant obliged to pay, yet, unfortunately never did. Hence the suit. The defendant argued that the suit was statute barred, and the trial court held accordingly. Upon appeal, this decision was quashed, and an order of retrial was made. In 1988, the matter was relisted, again the defendant filed an application for dismissal which the trial court refused. The defendant then appealed to Court of Appeal which in turn dismissed the appeal, while condemning in strong terms the orchestrated delay tactics employed by the defendant in the suit. It is evident the incessant attempts by the defendant in the above extant case to frustrate proceedings and the eventual determination of the suit for fear of being found liable. Such is the predicament of cases under the rule in Ryland's case, as defaulters who are mostly multinationals, and big entities with large pockets strong enough to employ all forms of legal technicalities in order to delay the swift prosecution of matters, often do so.[46]

These legal technicalities could come in the form of incessant appeals of interlocutory applications, inordinately consistent application for adjournment, inability of judges to deliver judgment/ decisions timeously, incessant interlocutory applications targeted to frustrate proceedings, etcetera. Also significant, is the issue of the attitude of the Courts towards the quantum of damages to be awarded. Damages are meant to assuage a plaintiff of suffering associated to the default of the defendant. It serves both as recompense and deterrent, hence it should be sizably commiserated enough to effect these purposes.[47] Nigerian Court tends to be very frugal in dispensing with justice when it comes to awarding damages, and this has in no small way discouraged litigants in their pursuit for legal remedy. The case of *Shell Petroleum Development Co Ltd v. Teibo*,[48] is very instructive in this regard. The plaintiff community claimed the sum of N64 million as general damages for defendant's oil spill into a river which served the common purpose as a source of drinking and fishing. The plaintiffs also alleged the desecration of their ancestral shrine. The Court upon finding the defendants liable in terms of

[46] D Olowo, Environmental Governance Challenges in Kiribati: An Agenda for Policy Responses (2007) 3(3) *Law, Environment and Development Journal* 262 https//www.leadjournal.org/cpntent.com accessed on 13th September, 2023.

[47] D Olowo, Environmental Governance Challenges in Kiribati: An Agenda for Policy Responses (2007) 3(3) *Law, Environment and Development Journal* 262 https//www.leadjournal.org/cpntent.com accessed on 13th September, 2023.

[48] (1996) 4 NWLR (Pt 445) 657.

the plaintiff's claim awarded a paltry sum of N6 million as damages to the plaintiff community. The rule may require expert witness in other to make a case under it. It is usually such that there are certain scientific and technical approaches that needs to be adopted in order to adequately understand and appreciate the connection between the act of the defendant and the damages caused by the plaintiff.[49]

Forensic or Expert evidence may also be needed in order to properly evaluate the extent of damage so occasioned, if not a case built on the rule will fall like a pack of cards. This poses big problem because most litigants do not possess the financial wherewithal to procure the service of said experts in proof of their case, hence leaving the privilege solely to the multinational companies and organizations who are often the defendants in cases such as this. The case of *Seismograph Services limited v. Onokpasa*[50]is very instructive in this regard. Here the plaintiff, a proprietor of a school claimed the defendant's seismic blast within the area caused cracks to his school's building structures. The defendant called a chartered structural engineer, geologist and seismologist respectively, as expert witnesses in support of their defense, while the plaintiff called one skilled enough in the field of building structures. The trial Court held in favour of the plaintiff awarding compensation. On appeal, the Supreme Court held that the trial Judge ought to have relied on the expert witness of the defendant/appellant in reaching its decision. The Court Per Sowemimo JSC (as he then was) opined inter alia:

> The contention of each party is of a technical nature therefore such evidence as could support it must necessarily be that of people specially qualified in particular field of service which is in this case comprise the knowledge and practice of seismology and civil engineering. It is on the examination of such evidence, as is considered relevant that a determination must be arrived at, so as to determine cause of alleged damage.[51]

It is important to note that the tort principles of negligence, nuisance and even trespass are also fraught with similar problem. Another problem is the enforcement of Court orders. The joy of victory to a judgment creditor lies only when orders made by the Court are completely executed. Sometimes after jumping through the hurdles of prosecuting a case successfully in

[49] (n108) 262.
[50] (1972) All NLR 347; *Seismograph Service Akporuovo* (1974) All NLR 97; *Ogaile v. Shell Petroleum Development Co. Ltd.* (1997) 1 NWLR (Pt 480) 148.
[51]Ibid.

court, it is often the case of enforcement of said judgment that becomes the issue. Some big-pocket judgment debtors, against whom judgment has been given, may resort to frustrating the enforcement process through every conceivable means possible. It then behooves on the judgment credit or to take steps to ensure their victory is not a pyrrhic one. Other problems include, but not limited to, illiteracy of litigants, ignorance of the law on the part of victims, fear of retribution, etcetera.

DEFENCES TO THE *RULE IN RYLAND vFLETCHER*

To every general rule, there is an exception. Exceptions are possible defenses which if proved and upheld will exculpate the defendant from all liability. The rule as established in Ryland's case enjoys some of such defenses. To wit:

a. Contributory Negligence.
b. Consent of the plaintiff.
c. Fault of the plaintiff.
d. Act of God.
e. Act of a Third Party.
f. Statutory Authority

(a) Contributory Negligence

This is basically negligence of the plaintiff himself which combines with the defendant's negligence in bringing about the injury to the plaintiff.[52] This envisages a situation where an actionable tort occurs, but not without the fault of the supposed plaintiff. Here the defendant is liable but at the same time, the plaintiff contributed one way or the other to acts that led to his liability. In this case, the defendant will only be liable to the extent where he alone is at fault.[53]

(b) Consent of the plaintiff

As the phrase implies, it is a situation where the damage or the thing which resulted to the damage was occasioned with the consent of the plaintiff. For instance, where a plaintiff consents to the bringing and keeping of a non-natural thing unto the defendant's land knowing its natural consequence, he cannot turn around to claim liability against the defendant in the

[52]*Bowens v Brimell* (1977) QB 859.
[53]Ibid.

event of damage arising there from. As instance is when a thing is brought unto the defendant's land for the mutual enjoyment and benefit of both plaintiff and defendant, consent is implied as the plaintiff cannot claim liability over the defendant in the event of damage arising therefrom.[54]

(c) **Fault of the Plaintiff**

This is when the act, subject matter of the suit is solely the fault of the plaintiff. It stands as an obvious defence in favour of the defendant without anything more. Even the Harmful Waste Act[55] exempts liability for damages caused by any harmful waste deposited or dumped on any land or territory of Nigeria, where such depositis solely the fault of the person who eventually suffers it; or when it was suffered by a person who voluntarily accepts the risk thereof.

(d) **Act of God**

These are events that occur without human interference or error. For instance, if the water that destroyed Ryland's coal mine had been situated on fletcher's land naturally, and the escape of the water happens without human interference, fletcher would not be liable. In this case, it would be termed an 'Act of God', because there was no human interference, and will stand as a defense in Court.[56]

(e) **Act of a Third Party**

This is a tricky one. This is because, using the facts in the rule, Fletcher would have argued that the error leading to the escape was due to the act of a third party, that is, the contractors he had employed. However, we find clarity in the fact that the contract or sacted at his behest. This defense applies where a defendant can prove that the said escape was due to the independent act of a total stranger, trespasser, third party, etc., having no link, with respect to the damage, to his person, or without negligence on his part.[57]

(f) **Statutory Authority**

[54]*Reddunan v Smith* (1889) 60 LT 708.
[55]*Harmful Waste* (Special Criminal Provisions etc.) Act 1988 s12(1).
[56]*Nichols v. Marsland* (1876) 2 ExD1.
[57]*Perry v Kendrick Transport Ltd* (1956) 1 WLR 85.

By virtue of a statutory munities to be enjoyed by public officers in the execution of the their statutory duties, liability under this rule will not affect them. This however only applicable where they are within the confines of the laws prescribing these duties, and are not negligent per se, in carrying out said duties. In other words, a public officer in providing certain basic amenities like water, electricity, etc., shall not be held liable for any damage occasioned therefrom, as long as they act prudently, and within the scope of the statutory duties, and also in consonance with the law.[58]

REMEDIES FOR BREACH OF THE RULE IN *RYLAND v FLETCHER*

Not unlike most tortuous liability actions, strict liability affords an aggrieved plaintiff certain reliefs before the Court in order to seek redress. When redress is such as to attract compensation by way of pecuniary effects, abatement or restitution from a defaulter, it is a civil wrong. While if it is to exert some penalty or sanction in form of fine or imprisonment, it is criminal. Being a civil wrong, in the rule under review, the following claims can be sought jointly or separately. To wit;

a. Damages
b. Injunction

Claim for Damages

This is as to the extent of damage suffered by the plaintiff as a result of the defendant's act from which a cause of action arose, translated and awarded by the court as compensation in pecuniary terms in favour of the plaintiff. It could be with respect to the destruction of the plaintiff's property, or injury to his person. This claim is meant to assuage the suffering of the plaintiff.[59]

Injunction

In cases where the destructive act, subject matter of a suit persists, and continuously causes harm on the property or the person of the plaintiff, an injunction can be sought to stop said act. This type of claim is perfect for cases of oil spillage, emission of toxic fumes and wastes, etc.

[58]*Sedleigh Denfield v O'Callaghen* (1940) AC 880.
[59]*Cheetham v Hampson* (1791) 100 ER 1041.

Here the plaintiff(s) simply prays the Court for either an interim, interlocutory or perpetual injunction to stop the dastardly act causing harm to him and the environment.[60]

CONCLUSION.

The researcher learnt that the Rule in Ryland v Fletcher has been effectively used to control and prevent environmental pollution in other jurisdictions such as India, Canada and Kenya. The rule is also strictly construed in other jurisdictions when the Court wants to apply the rule in Ryland v Fletcher. The researcher also learnt that the rule is not applied to cases of land in other jurisdiction. that in other to control environmental pollution in Nigeria, Nigerian government must demonstrate sincerity of purpose and a clear political will towards strengthening and implementing the environ mental regulatory framework in the industries. The judicial arm of the government should be strengthened the more in order to prevent interference from external sources to pervert justice or giving decision that will not affect those persons involved in environmental pollution.

RECOMMENDATIONS

Given the evolving nature of tort law and the declining standalone application of the Rylands v Fletcher rule, several areas warrant further research:

1. Comparative Jurisdictional Analysis:

Future studies should compare how various common law jurisdictions (such as the UK, India, Nigeria, and Australia) have interpreted and applied the rule. This can highlight the rule's flexibility or obsolescence in modern tort regimes.

2. Integration with Environmental Law:

With growing environmental concerns, there is potential for the rule to be revisited in the context of environmental liability, particularly regarding industrial pollution and hazardous waste disposal. Researchers should investigate the intersection between Rylands v Fletcher and statutory environmental protections.

3. Relevance in Modern Industrial Practices:

[60]*Mahon v Osborne* (1939) 2KB 14.

Further empirical research could analyze the extent to which industries implement safeguards that would satisfy or render the Rylands rule redundant. Case studies from sectors like mining, chemical manufacturing, and water management may be particularly insightful.

4. Doctrinal Re-evaluation:

Scholars may explore whether strict liability under Rylands v Fletcher should be preserved as a distinct doctrine or formally merged into broader principles of negligence or nuisance, considering modern legal trends and overlapping doctrines.

5. Human Rights Implications:

There is scope to examine the rule's utility in protecting community rights to health and property in light of increasing recognition of environmental rights as human rights.

ARTIFICIAL INTELLIGENCE (AI) IN BIODIVERSITY POLICY DESIGN: DEVELOPING AI-DRIVEN DECISION SUPPORT SYSTEMS FOR CONSERVATION POLICY-MAKING

WOHA, Etheldred E.*
EKPOH, Nancy Akins**

ABSTRACT

Biodiversity is essential for ecosystem functionality and human well-being, yet it faces unprecedented threats from habitat loss, climate change, pollution, invasive species, and overexploitation. Conservation policy-making, often hampered by incomplete data and complex ecological interactions, requires innovative approaches to address these challenges effectively. AI offers transformative opportunities to revolutionize biodiversity policy design through advanced Decision Support Systems (DSS). By integrating data, simulating ecological scenarios, and enabling adaptive management, AI-driven DSS can enhance the formulation, implementation, and evaluation of conservation policies. This article explores the theoretical underpinnings, practical applications, and ethical considerations of leveraging AI in biodiversity governance, underscoring the need for interdisciplinary collaboration and robust policy frameworks to maximize its potential. It is concluded that by leveraging AI's capabilities in data integration, scenario modeling, and real-time monitoring, policymakers can transition from reactive to proactive conservation strategies.

Keywords: *Biodiversity, Decision Support Systems, Artificial Intelligence*

INTRODUCTION

Biodiversity is a fundamental component of the health and sustainability of the planet. This is because, the systems that sustain all forms of life on Earth, including human beings, rely on biodiversity. The oxygen we breathe and the food we consume are both provided by healthy ecosystems, which in turn depend on a diverse array of plant and microbe life.[61]The role of biodiversity is essential for maintaining ecosystem resilience and stability. Research indicates that ecosystems exhibiting greater species diversity demonstrate enhanced resilience to environmental stressors, including climate change and invasive species.[62]Wetlands serve as vital ecosystems, offering essential functions like flood management, water purification, and habitats for a diverse array of species. The connection between wetland cover and species diversity demonstrates a positive correlation, where regions with extensive wetland cover tend to support increased species

* WOHA, Ethedred E., *PhD (RSU), LL.M (RSU), LLB (ABU Zaria) BL, Lecturer, Department of Private and Property Law, Faculty of Law, Rivers State University, Port Harcourt. Email- Etheldred.woha1@ust.edu.ng.*
**EKPOH, Nancy Akins,*PhD (RSU), LL.M (RSU), LLB (NDU) BL, Lecturer, Department of Jurisprudence and International Law, Faculty of Law, Rivers State University, Port Harcourt. Email- nancy.ekpoh@rsu.edu.ng*

[61] L Flandroy and others, 'The Impact of Human Activities and Lifestyles on the Interlinked Microbiota and Health of Humans and of Ecosystems' (2018)(627) *Science of the Total Environment* 1018.

[62] A O Iyiola, B Asiedu, E O Oyewole and A J Akinrinade, *Impacts of Climate Change on Aquatic Biodiversity in Africa' in Biodiversity in Africa: Potentials, Threats and Conservation* (Springer Nature Singapore 2022) 369.

richness, especially among birds and amphibians.[63]The earth is however increasingly under threat from human activities such as deforestation, poaching, and illegal logging. Traditional conservation methods often struggle to keep up with the scale and speed of these activities. In response, artificial intelligence (AI), particularly in the form of machine learning and deep learning algorithms, has emerged as a promising tool for real-time biodiversity threat detection.[64]Technological innovations are crucial for addressing the growing challenges of biodiversity loss and ensuring the long-term sustainability of ecosystems.[65]Satellite imagery provides an invaluable resource for monitoring large and remote areas of the world's ecosystems. With the help of AI, this imagery can be analyzed more efficiently and accurately than through human observation alone. AI algorithms can identify subtle changes inland cover, detect illegal activities, and predict potential future threats.[66] In this article, we explore how AI technologies are being used to analyze satellite data for early detection of deforestation and illegal activities, offering real-time solutions to biodiversity conservation.[67]

THE ROLE OF AI IN BIODIVERSITY POLICY DESIGN DATA INTEGRATION AND ANALYSIS

AI refers to the creation of computer systems or applications designed to carry out tasks that typically require human intelligence, including problem-solving and decision-making.[68]One of AI's most powerful contributions is its ability to aggregate and analyze heterogeneous data. The application of AI to biodiversity monitoring relies on diverse sources, including satellite imagery, field surveys, citizen science platforms, and remote sensing technologies. AI algorithms,

[63] Victoria Bukky Ayoola and others, 'The Role of Big Data and AI in Enhancing Biodiversity Conservation and Resource Management in the USA' (2024) 23(02) *World Journal of Advanced Research and Reviews* 1851.

[64] 'Millennium Ecosystem Assessment, *Biodiversity and Ecosystem Services: A Global Assessment of the Links Between Biodiversity, Ecosystem Functioning, and Ecosystem Services'* (2005) <www.millenniumassessment.org>accessed 4 December 2024.

[65] Ayoola (n3)

[66] O Venter and others, 'Global Terrestrial Human Footprint Maps for 1993 and 2009 and the Implications for Biodiversity Conservation' (2017)(356) *Science*, 427 https://doi.org/10.1126/science.aaf3807 accessed 4 December 2024.

[67] D Khlopin and others, 'Artificial Intelligence in Biodiversity Conservation: A Review' (2018)(62) *Environmental Management* 799 https://doi.org/10.1007/s00267-018-1093-6 accessed 4 December 2024.

[68] U A Okengwu and others, 'Environmental and Ethical Negative Implications of AI in Agriculture and Proposed Mitigation Measures' (2023)(22)(1) *Scientia Africana* 141.

particularly in the domain of machine learning, can identify patterns and trends that are otherwise imperceptible to human analysts. For example, convolutional neural networks are increasingly used for land cover classification, enabling researchers to detect habitat loss and fragmentation with high precision. Such insights are critical for identifying priority areas for conservation and designing targeted interventions. Moreover, Natural Language Processing can analyze policy documents, research papers, and social media to assess public sentiment and policy coherence, further enriching the decision-making process.[69]

SCENARIO MODELING AND PORTECTION

AI facilitates the modeling of complex ecological systems, providing policymakers with the tools to simulate various scenarios and predict outcomes of potential interventions. Reinforcement learning, a subset of AI that uses trial-and-error to optimize strategies, has shown promise in managing protected areas by balancing ecological integrity with socio-economic objectives. For instance, predictive habitat models such as MaxEnt (Maximum Entropy) use species occurrence data to forecast habitat suitability under different climate change scenarios. These models inform land-use planning and resource allocation, ensuring that limited conservation funds are directed toward the most critical regions.[70]

REAL-TIME MONITORING ND ADAPTIVE MANAGEMENT

In recent years, real-time monitoring has become an indispensable tool in the realm of conservation. As threats to biodiversity, such as habitat destruction, poaching, and climate change, increase in both scale and complexity, the traditional methods of conservation are no longer sufficient. AI-driven systems, with their capacity for continuous, automated, and large-scale monitoring, provide a powerful means to detect and respond to emerging threats in real-time. This evolution in monitoring technologies allows conservationists to not only identify problems as they arise but to also implement adaptive management strategiesadjusting conservation practices based on dynamic ecological, social, and economic factors.[71]

[69]Venter (n 6).
[70] J Elith and others, 'A Statistical Explanation of MaxEnt for Ecologists' (2011)(17) *Diversity and Distributions*, 43. <https://doi.org/10.1111/j.1472-4642.2010.00725.x> accessed 4 December 2024.
[71]A Antonelli and others, 'Optimizing Biodiversity Protection Through Artificial Intelligence' (bioRxiv, 2 October 2021) <https://doi.org/10.1101/2021.04.13.439752> accessed 4 December 2024.

BIOACOUSTIC MONITORING AND AI INTEGRATION

One of the most promising AI applications in biodiversity monitoring is bioacoustic technology. Bioacoustics is an interdisciplinary domain that integrates biological and acoustic sciences, employing sound technology to capture, preserve, and analyse extensive datasets of animal communication.[72]This technology assists researchers in collecting data on species presence, abundance, behaviour, and interactions within an ecosystem.

Bioacoustic sensors, coupled with machine learning algorithms, enable the analysis of sounds in ecosystems to gather insights on species presence, behavior, and population trends. These sensors can be deployed in remote and difficult-to-access regions, including tropical rainforests, savannas, and marine environments, where traditional wildlife observation would be logistically challenging or prohibitively expensive.

By analyzing the sounds of birds, insects, amphibians, and mammals, bioacoustic sensors can detect patterns in biodiversity that would otherwise be difficult to observe. AI algorithms, particularly those employing deep learning models, are adept at processing these complex audio signals to identify species-specific calls and track behavioral shifts. For example, in tropical rainforests, AI can discern subtle changes in the vocalizations of endangered species, indicating shifts in their population dynamics or behaviors linked to stress factors such as habitat loss or human encroachment. Such real-time data collection allows conservationists to respond quickly to any emerging threat, such as the intrusion of illegal logging operations or the onset of habitat degradation, offering a real-time, non-invasive way to monitor and protect biodiversity.[73]

The ability to continuously monitor wildlife and detect behavior changes opens up the potential for real-time ecological assessments. Conservationists can track not only the presence or absence of certain species but also monitor seasonal migrations, reproduction rates, and the overall health of ecosystems. This bioacoustic data, analyzed using AI models, can serve as a dynamic

1. [72]Weronika Penar and others, 'Applications of Bioacoustics in Animal Ecology' (2020)(43)(4) *Ecological Complexity* 100847.

[73] J Sueur and others, 'Bioacoustics and Machine Learning: Tools for Monitoring Biodiversity' (2019)(231) *Biological Conservation* 26 <https://doi.org/10.1016/j.biocon.2019.01.022> accessed 4 December 2024.

early warning system for conservation threats, allowing for rapid intervention in a way that was not possible with earlier methods reliant on manual observation or intermittent field surveys.

DRONES AND COMPUTER VISION FOR ECOLOGICAL SURVEILLANCE

Another promising technology for real-time biodiversity monitoring is the use of drones equipped with computer vision algorithms. Drones offer an unprecedented ability to monitor vast and inaccessible areas, providing real-time aerial footage and high-resolution images that can be processed using AI. Drones, coupled with AI-powered computer vision, can track deforestation, illegal logging, poaching, and other forms of environmental degradation that are often difficult to detect through traditional methods.

For instance, in the Congo Basin, drones have been deployed to monitor illegal logging activities that would otherwise go unnoticed due to the dense canopy and remote location of these areas. Through computer vision, AI systems can analyze the imagery captured by the drones to detect signs of logging operations, such as the presence of freshly cut trees or the creation of new access roads. This real-time data is invaluable for enforcement agencies, who can then take immediate action based on the information gathered, whether it involves mobilizing anti-poaching teams or alerting local authorities to halt illegal logging operations.[74]

Moreover, computer vision algorithms can distinguish between different types of land cover, enabling the identification of deforestation, forest fragmentation, and land use changes in near real-time. This capacity for near-instantaneous analysis accelerates decision-making processes, ensuring that conservation strategies remain relevant and responsive. The integration of drones and AI into conservation management not only enhances surveillance but also reduces the need for costly and time-consuming manual patrols, which can be resource-intensive and often prone to human error.[75]

[74] D Anderson and S Nair, 'Drones and Conservation: Real-Time Monitoring of Environmental Threats' (2020)(25)(4) *Journal of Conservation Technology*, 214 <https://doi.org/10.1016/j.jct.2020.06.002> accessed 4 December 2024.

[75] M M Quamar and others, 'Advancements and Applications of Drone-Integrated Geographic Information System Technology:A Review' (2023) 15 *Remote Sensing* 5039. <https://doi.org/10.3390/rs15195039> accessedDecember 2024; J Eze, *Development of a Framework for Integrated Oil and Gas Pipeline Monitoring and Incident Mitigation System (IOPMIMS)* (University of Wolverhampton 2017) <http://hdl.handle.net/2436/620898> accessed 4 December 2024.

ADAPTIVE MANAGEMENT THROUGH REAL-TIME FEEDBACK

The ability to collect real-time data through AI-driven systems provides the foundation for adaptive management, a dynamic conservation strategy that allows for the flexible and responsive adjustment of conservation practices. Adaptive management is built on the premise that ecosystems are complex and subject to a range of unpredictable forces, both natural and human-induced. Therefore, policies and practices must be continually adjusted based on the most up-to-date information available, rather than relying on static or outdated management plans.

With AI-enhanced monitoring, conservation managers can continuously evaluate the effectiveness of their strategies and make informed adjustments. For example, if AI-based monitoring reveals that a particular protected area is under threat from illegal fishing or poaching, conservation authorities can immediately implement new policies, such as increased patrols or the imposition of temporary fishing bans, based on real-time data. Similarly, AI-driven models can track the long-term effectiveness of reforestation projects, adjusting resource allocation and strategies based on observed trends, such as the growth rate of tree saplings or changes in local biodiversity as a result of the restoration effort.[76]

This capacity for rapid feedback and iterative decision-making is particularly crucial in areas where time is of the essence, such as in combating wildlife trafficking, habitat loss, or the impacts of climate change. AI-powered monitoring systems can track and predict ecological changes, providing a window into future scenarios. For example, predictive models based on real-time satellite data can forecast how climate change will alter habitat suitability for certain species, allowing policymakers to plan ahead for future conservation needs.[77]

REAL-TIME MONITORING AND ADAPTIVE MANAGEMENT

In recent years, real-time monitoring has become an indispensable tool in the realm of conservation. As threats to biodiversity, such as habitat destruction, poaching, and climate change, increase in both scale and complexity, the traditional methods of conservation are no longer sufficient. AI-driven systems, with their capacity for continuous, automated, and large-scale

[76] M K Sharma and others, 'Tech-Driven Solutions for Environmental Conservation by AI Collaboration Processes' in *Environmental Applications of Carbon-Based Materials* (IGI Global 2024) 1.

[77] 'TAA Prowse and others, 'Predicting Habitat Suitability Under Climate Change: The Role of AI in Conservation Planning' (2020)(30) *Ecological Applications* e02155 <https://doi.org/10.1002/eap.2155> accessed 4 December 2024.

monitoring, provide a powerful means to detect and respond to emerging threats in real-time. This evolution in monitoring technologies allows conservationists to not only identify problems as they arise but to also implement adaptive management strategiesadjusting conservation practices based on dynamic ecological, social, and economic factors.

BENEFITS OF REAL-TIME MONITORING AND ADAPTIVE MANAGEMENT

AI systems, particularly those using machine learning, are capable of analyzing complex datasets more accurately and quickly than human analysts. This leads to more precise identification of emerging threats and more accurate predictions of ecological trends. Also, traditional biodiversity monitoring methods often require significant human resources, extensive fieldwork, and high operational costs. AI systems, particularly those using drones and remote sensors, reduce the need for on-the-ground personnel and provide a more cost-effective means of large-scale monitoring.In addition, the ability to monitor ecosystems in real-time ensures that conservation responses can be swift and targeted. This is particularly important for addressing threats such as illegal logging, poaching, or habitat destruction, which often require immediate intervention to prevent irreversible damage.Furthermore,AI-driven systems can be deployed across large and remote regions, allowing for the monitoring of ecosystems that would otherwise be difficult or impossible to reach. This scalability makes AI a particularly valuable tool for monitoring biodiversity hotspots in developing countries where conservation resources are limited.AI provides conservation managers with robust, data-driven insights, reducing reliance on anecdotal evidence or outdated assumptions. This leads to more informed and effective conservation policies that are tailored to the specific needs of the ecosystem and species being monitored.

CHALLENGES AND ETHICAL CONSIDERATIONS

The deployment of AI in agriculture presents ethical and environmental concerns that have arisen or may arise.These issues include bias in the dataset used to create some of these AI-based models, users' mistrust of the security and privacy of their data, unreliable power supplies, and carbon emissions from different electronic gadgets that enable the negative environmental effects of AI.[78]

[78] U A Okengwu and others, 'Environmental and Ethical Negative Implications of AI in Agriculture and Proposed Mitigation Measures' (2023) 22(1) *Scientia Africana* 141-150.

Flowing from this, it is clear that while AI-driven Decision Support Systems (DSS) offer transformative potential for biodiversity conservation, they are not without a set of critical challenges and ethical dilemmas that must be addressed to ensure their successful and equitable implementation. These challenges span technical, social, and ethical dimensions, and include:

DATA LIMITATIONS AND ACCESSIBILITY

The efficacy of AI in biodiversity monitoring is fundamentally dependent on the availability and quality of data. In many regions, particularly in the Global South, the absence of reliable and comprehensive biodiversity data significantly limits the applicability of AI models. While satellite imagery, remote sensing technologies, and bioacoustic data can provide valuable insights, gaps in local field data, ecological baselines, and species-specific information create substantial hurdles for model accuracy and predictive reliability. Moreover, the underrepresentation of certain ecosystems and biodiversity hotspots in global datasets can lead to incomplete or biased predictions, potentially overlooking critical areas requiring conservation attention. Consequently, AI models in biodiversity conservation often rely on assumptions that may not fully reflect local ecological realities, thus hindering the effectiveness of conservation policies.[79]

ALGORITHMIC BIAS AND EQUITY ISSUES

A significant concern with the deployment of AI in biodiversity monitoring is the risk of algorithmic bias. AI systems are only as good as the data on which they are trained, and biases embedded in the training datasets can result in skewed outcomes. In the context of biodiversity, biased data could lead to underrepresentation of certain species or ecosystems, particularly those that are not adequately documented or that have been historically overlooked in conservation priorities. Furthermore, if these biases are not addressed, AI systems could disproportionately benefit certain regions or species, exacerbating inequities in conservation efforts. This concern is particularly pertinent when considering the use of AI to allocate conservation resources or prioritize species for protection. Addressing this issue requires the development of more inclusive

[79].T Brooks and others, 'Global Biodiversity Conservation Priorities' (2006)(313) *Science*, 58. <https://doi.org/10.1126/science.1127609> accessed 4 December 2024.

and diverse datasets that capture the complexity and richness of ecosystems across the globe, ensuring equitable outcomes for all regions and species.[80]

HIGH COSTS OF DEVELOPMENT AND DEPLOYMENT

The development and implementation of AI-driven DSS in biodiversity conservation are resource-intensive, both in terms of financial and technical requirements. Sophisticated AI models necessitate substantial investments in computational infrastructure, specialized expertise, and long-term maintenance. This presents a significant barrier for resource-poor regions, where funding constraints may limit the ability to access or effectively deploy AI tools. Furthermore, the training of AI models requires vast amounts of data and computational power, which may be out of reach for many conservation organizations or government agencies, especially in low-income countries. The disparity in access to these technologies between high-income and low-income regions could result in uneven benefits, leaving some areas of the world without the tools needed for effective biodiversity monitoring and protection. Overcoming this barrier requires innovative funding models, international collaboration, and technology transfer mechanisms to ensure that AI is accessible and useful in all contexts.[81]

ETHICAL CONSIDERATIONS AND PRIVACY CONCERNS

AI-driven monitoring technologies, such as drones, surveillance cameras, and bioacoustic sensors, offer unprecedented capabilities for tracking wildlife and detecting illegal activities. However, their use raises important ethical and privacy concerns, particularly when deployed in or around indigenous and local communities. The pervasive surveillance that AI enables can infringe upon the rights of individuals, potentially leading to surveillance overreach, data misuse, or violations of privacy. Indigenous groups and local communities may feel marginalized by these technologies, particularly when they are not consulted in the decision-making processes or when the technologies are implemented without their consent. Ethical concerns also arise regarding the use

[80] S Chander and others, 'Addressing Bias in Machine Learning Algorithms in Biodiversity Conservation' (2019)(2) *Nature Sustainability*, 899 <https://doi.org/10.1038/s41893-019-0271-5>accessed 4 December 2024.

[81] A Van der Veen and others, 'The Role of Artificial Intelligence in Conservation: Opportunities and Challenges' (2020) 244 *Biological Conservation,* 108494 <https://doi.org/10.1016/j.biocon.2020.108494> accessed 4 December 2024.

of AI to monitor human behavior, as surveillance tools may inadvertently target vulnerable populations or criminalize otherwise legal activities. To mitigate these concerns, it is crucial that AI technologies be developed and deployed in a manner that respects local governance structures, community rights, and consent processes, ensuring that indigenous and local knowledge systems are integrated into conservation efforts.[82]

POLICY RECOMMENDATIONS

To realize the full potential of AI in biodiversity policy design and ensure that its benefits are equitably distributed, the following policy measures are recommended. These recommendations focus on improving data management, enhancing collaboration, and ensuring ethical practices.

INVESTMENT IN INFRASTRUCTURE AND CAPACITY BUILDING

Governments and international organizations should prioritize investments in AI research, data collection infrastructure, and computational resources, particularly in regions that are currently underrepresented in biodiversity monitoring efforts. This includes funding for the establishment of local data repositories, the improvement of satellite and sensor networks, and the development of AI-powered platforms tailored to the needs of specific ecosystems. Moreover, capacity-building programs aimed at training local experts in AI and data science should be established to ensure that there is a sustainable pool of local talent capable of driving AI innovation in biodiversity conservation at the regional level. This would alsofoster local ownership and ensure that AI tools are more appropriately designed for local contexts.[83]

FOSTERING PUBLIC-PRIVATE PARTNERSHIPS

[82] L Parrott and others, 'Ethical Concerns in the Application of AI in Conservation Monitoring' (2020)(42) *Environmental Ethics*, 317 <https://doi.org/10.5840/enviroethics202042318> accessed 4 December 2024.

[83] R J Scholes and others, 'Enhancing Conservation Efforts with AI: Building Capacity in Developing Regions' (2018) (62) *Environmental Management*, 983 <https://doi.org/10.1007/s00267-018-1062-1> accessed 4 December 2024; S Akter, 'Harnessing Technology for Environmental Sustainability: Utilizing AI to Tackle Global Ecological Challenges' (2024)(2) *Journal of Artificial Intelligence General Science (JAIGS)* 49.

Collaboration between technology companies, governmental bodies, and conservation organizations is essential to accelerating the development and deployment of AI-driven conservation tools. By leveraging the expertise and resources of the private sector, especially in the fields of machine learning and satellite technology, governments and NGOs can better scale their conservation efforts. Public-private partnerships can also facilitate the development of cost-effective AI tools that are adaptable to the needs of diverse conservation stakeholders. Collaborative efforts should focus on reducing barriers to AI adoption in low-resource regions, promoting knowledge exchange, and fostering innovation that addresses the unique challenges faced by biodiversity hotspots around the world.[84]

STRENGTHENING LEGAL AND ETHICAL FRAMEWORKS

To ensure that AI technologies are used responsibly and ethically in biodiversity conservation, it is essential to develop comprehensive legal frameworks that govern their deployment. These frameworks should address issues such as data privacy, informed consent, and the protection of human rights, particularly in relation to indigenous and local communities. Additionally, regulations should be established to prevent the misuse of AI surveillance technologies and to ensure that AI-driven decision-making processes are transparent and accountable. By implementing such frameworks, governments can create a conducive environment for the ethical use of AI in conservation, fostering trust among stakeholders and ensuring that AI applications align with global conservation goals.[85]

PROMOTING GLOBAL KNOWLEDGE SHARING AND ACCESS

Given the complex and interconnected nature of global biodiversity, it is essential to foster international cooperation in the development of AI tools for conservation. This includes the sharing of best practices, data, and AI models across borders to ensure that the tools are applicable in diverse ecological contexts. International platforms for knowledge exchange should be

[84] M Leung and others, 'Public-Private Partnerships in AI and Conservation: Bridging the Gap' (2018) 52 *Environmental Science & Technology* 10752 <https://doi.org/10.1021/acs.est.8b04292.> accessed 18 December 2024.

[85] J Lin and H Shi, 'Regulating AI Technologies in Environmental Conservation: Legal Frameworks for Ethical Use' (2020)(22) *Environmental Law Review*, 45 <https://doi.org/10.1177/1461452920903229> accessed 18 December 2024.

established to promote collaboration between research institutions, conservation practitioners, and policymakers. Such platforms would facilitate the scaling of successful AI-driven conservation strategies and ensure that AI tools are accessible and relevant to all regions, including those in the Global South.[86]

CONCLUSION

AI-driven DSS represents a transformative opportunity to address the biodiversity crisis by integrating science, technology, and policy. By leveraging AI's capabilities in data integration, scenario modeling, and real-time monitoring, policymakers can transition from reactive to proactive conservation strategies. However, realizing this potential requires careful attention to ethical considerations, equitable resource allocation, and inclusive governance.

[86] W Turner and others, 'Global Collaboration in AI-Driven Conservation: Sharing Knowledge and Resources' (2020)
(34) *Conservation Biology*, 373 <https://doi.org/10.1111/cobi.13456> accessed 18 December 2024.